DEPARTMENT OF THE ARMY TECHNICAL MANUAL

DEPARTMENT OF THE AIR FORCE TECHNICAL ORDER

TM 11-2684A

TO 16-35TS312-16

AUDIO OSCILLATOR

TS-382A/U

DEPARTMENTS OF THE ARMY AND THE AIR FORCE

MAY 1952

AGO 3471A—Apr

AUDIO OSCILLATOR

TS-382A/U

United States Government Printing Office
Washington: 1952

AGO 3471A

DEPARTMENTS OF THE ARMY AND
THE AIR FORCE

WASHINGTON 25, D. C., *9 May 1952*

TM 11–2684A/TO 16–35TS312–16 is published for the information and guidance of all concerned.

[AG 413.6 (19 Mar 52)]

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NG: Same as Active Army.

ORC: Same as Active Army.

For explanation of distribution formula, see SR 310–90–1.

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WARNING

HIGH VOLTAGE

is used in the operation
of this equipment.

DEATH ON CONTACT

may result if operating personnel
fail to observe safety precautions.

First Aid for Electric Shock

RESCUE.

In case of electric shock, shut off the high voltage at once and ground the circuits. If the high voltage cannot be turned off without delay, free the victim from contact with the live conductor as promptly as possible. Avoid direct contact with either the live conductor or the victim's body. Use a dry board, dry clothing, or other nonconductor to free the victim. An ax may be used to cut the high-voltage wire. Use extreme caution to avoid the resulting electric flash.

SYMPTOMS.

a. Breathing stops abruptly in electric shock if the current passes through the breathing center at the base of the brain. If the shock has not been too severe, the breath center recovers after a while and normal breathing is resumed, provided that a sufficient supply of air has been furnished meanwhile by artificial respiration.

b. The victim is usually very white or blue. The pulse is very weak or entirely absent and unconsciousness is complete. Burns are usually present. The victim's body may become rigid or stiff in a very few minutes. This condition is due to the action of electricity and is not to be considered rigor mortis. Artificial respiration must still be given, as several such cases are reported to have recovered. The ordinary and general tests for death should never be accepted.

TREATMENT.

a. Start artificial respiration immediately. At the same time send for a medical officer, if assistance is available. Do not leave the victim unattended. Perform artificial respiration at the scene of the accident, unless the victim's or operator's life is endangered from such action. *In this case only,* remove the victim to another location, but no farther than is necessary for safety. If the new location is more than a few feet away, artificial respiration should be given while the victim is being moved. If the method of transportation prohibits the use of the Shaeffer prone pressure method, other methods of resuscitation may be used. Pressure may be exerted on the front of the victim's diaphragm, or the direct mouth-to-mouth method may be used. Artificial respiration, once started, must be continued, without loss of rhythm.

b. Lay the victim in a prone position, one arm extended directly overhead, and the other arm bent at the elbow so that the back of the hand supports the head. The face should be turned away from the bent elbow so that the nose and mouth are free for breathing.

c. Open the victim's mouth and remove any foreign bodies, such as false teeth, chewing gum, or tobacco. The mouth should remain open, with the tongue extended. Do not permit the victim to draw his tongue back into his mouth or throat.

d. If an assistant is available during resuscitation, he should loosen any tight clothing to permit free circulation of blood and to prevent restriction of breathing. He should see that the victim is kept warm, by applying blankets or other covering, or by applying hot rocks or bricks wrapped in cloth or paper to prevent injury to the victim. The assistant should also be ever watchful to see that the victim does not swallow his tongue. He should continually wipe from the victim's mouth any frothy mucus or saliva that may collect and interfere with respiration.

e. The resuscitating operator should straddle the victim's thighs, or one leg, in such manner that:

(*1*) the operator s arms and thighs will be vertical while applying pressure on the small of the victim's back;

(*2*) the operator's fingers are in a natural position on the victim's back with the little finger lying on the last rib;

(*3*) the heels of the hands rest on either side of the spine as far apart as convenient without allowing the hands to slip off the victim;

(*4*) the operator's elbows are straight and locked.

f. The resuscitation procedure is as follows:

(*1*) Exert downward pressure, not exceeding 60 pounds, for 1 second.

(*2*) Swing back, suddenly releasing pressure, and sit up on the heels.

(*3*) After 2 seconds rest, swing forward again, positioning the hands exactly as before, and apply pressure for another second.

g. The forward swing, positioning of the hands, and the downward pressure should be accomplished in one continuous motion, which requires 1 second. The release and backward swing require 1 second. The addition of the 2-second rest makes a total of 4

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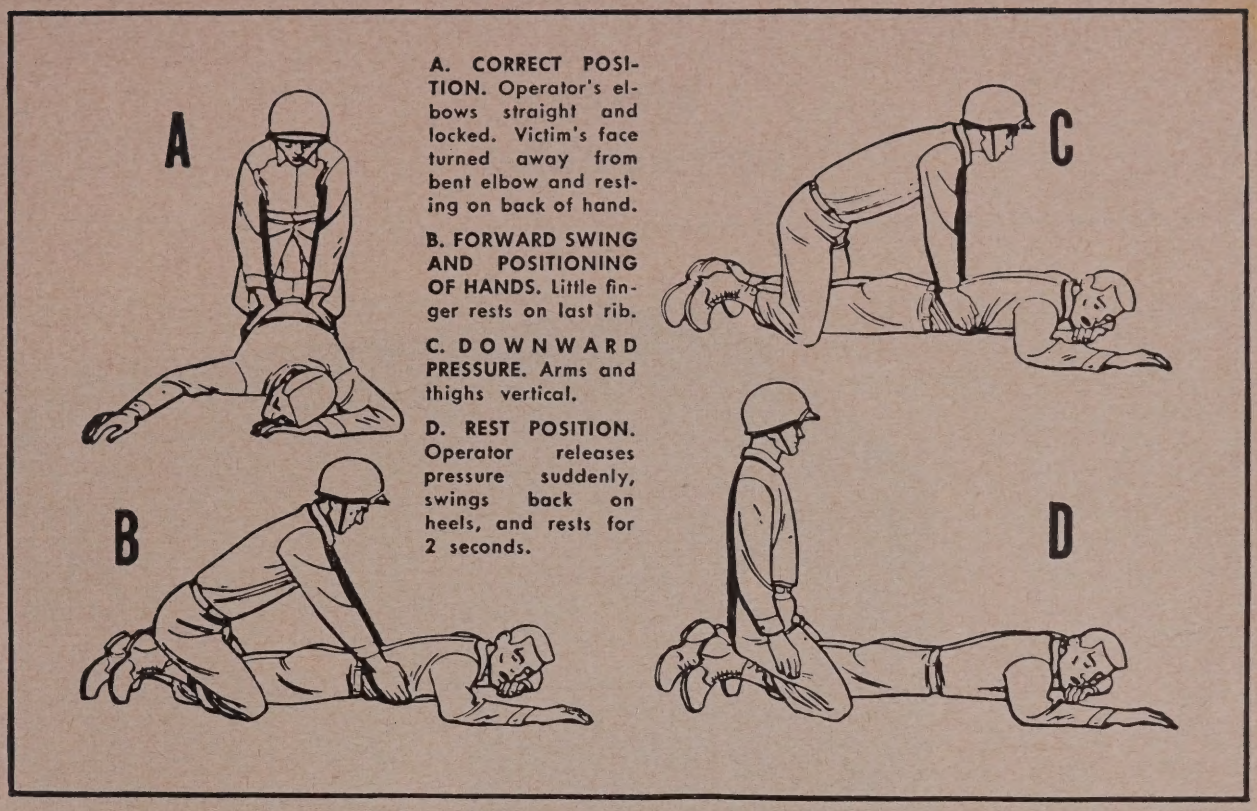
A
B
C
D
A. CORRECT POSITION. Operator's elbows straight and locked. Victim's face turned away from bent elbow and resting on back of hand.
B. FORWARD SWING AND POSITIONING OF HANDS. Little finger rests on last rib.
C. DOWNWARD PRESSURE. Arms and thighs vertical.
D. REST POSITION. Operator releases pressure suddenly, swings back on heels, and rests for 2 seconds.

seconds for a complete cycle. Until the operator is thoroughly familiar with the correct cadence of the cycle, he should count the seconds aloud, speaking distinctly and counting evenly in thousands. Example: one thousand and one, one thousand and two, etc.

h. Artificial respiration should be continued until the victim regains normal breathing or is pronounced dead by a medical officer. Since it may be necessary to continue resuscitation for several hours, relief operators should be used if available.

RELIEVING OPERATOR.

The relief operator kneels beside the operator and follows him through several complete cycles. When the relief operator is sure he has the correct rhythm, he places his hands on the operator's hands without applying pressure. This indicates that he is ready to take over. On the backward swing, the operator moves and the relief operator takes his position. The relieved operator follows through several complete cycles to be sure that the new operator has the correct rhythm. He remains alert to take over instantly if the new operator falters or hesitates on the cycle.

STIMULANTS.

a. If an inhalant stimulant is used, such as aromatic spirits of ammonia, the individual administering the stimulant should first test it himself to see how close he can hold the inhalant to his own nostril for comfortable breathing. Be sure that the inhalant is not held any closer to the victim's nostrils, and then for only 1 or 2 seconds every minute.

b. After the victim has regained consciousness, he may be given hot coffee, hot tea, or a glass of water containing ½ teaspoon of aromatic spirits of ammonia. *Do not give any liquids to an unconscious victim.*

CAUTIONS.

a. After the victim revives, keep him LYING QUIETLY. Any injury a person may have received may cause a condition of shock. Shock is present if the victim is pale and has a cold sweat, his pulse is weak and rapid, and his breathing is short and gasping.

b. keep the victim lying flat on his back, with his head lower than the rest of his body and his hips elevated. Be sure that there is no tight clothing to restrict the free circulation of blood or hinder natural breathing. Keep him warm and quiet.

c. A resuscitated victim must be watched carefully as he may suddenly stop breathing. *Never leave a resuscitated person alone until it is CERTAIN that he is fully conscious and breathing normally.*

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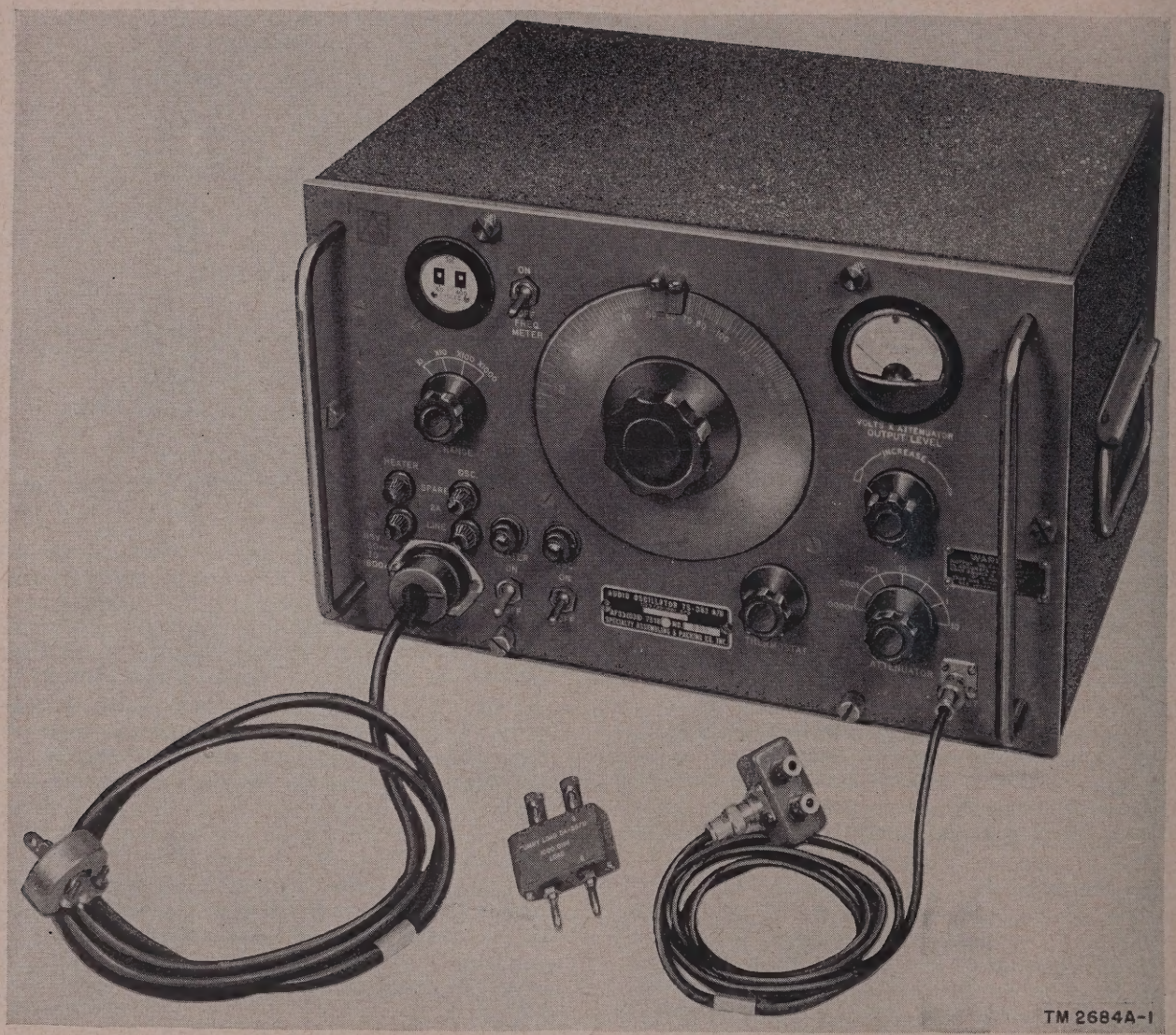


Figure 1. Audio Oscillator TS–382A/U.

CHAPTER 1
INTRODUCTION

Section I. GENERAL

1. Scope

This manual contains instructions for the installation, operation, maintenance, and repair of Audio Oscillator TS–382A/U (fig. 1). In addition to these instructions, there are two appendixes covering a list of references and an identification table of parts.

2. Forms and Records

a. DD Form 6, Report of Damaged or Improper Shipment, will be filled out and forwarded as prescribed in SR 745–45–5 (Army) and AFR 71–4 (Air Force).

b. DA Form 468, Unsatisfactory Equipment Report, will be filled out and forwarded to the Office of the Chief Signal Officer as prescribed in SR 700–45–5.

c. AF Form 54, Unsatisfactory Report, will be filled out and forwarded to Commanding General, Air Matériel Command, Wright-Patterson Air Force Base, Dayton, Ohio, as prescribed in SR 700–45–5 and AFR 65–26.

d. DA AGO Form 11–238, Operator First Echelon Maintenance Check List for Signal Corps Equipment (Radio Communication, Direction Finding, Carrier, Radar), will be prepared in accordance with instructions on the back of the form.

e. DA AGO Form 11–239, Second and Third Echelon Maintenance Check List for Signal Corps Equipment (Radio Communication, Direction Finding, Carrier, Radar), will be prepared in accordance with instructions on the back of the form.

f. Use other forms and records as authorized.

Section II. DESCRIPTION AND DATA

3. Purpose and Use

a. Audio Oscillator TS–382A/U is a laboratory device which generates a-c (alternating-current) voltages ranging from 20 to 200,000 cps (cycles per second) at amplitudes which may be varied continuously from 0 to 10 volts. The generated signal is accurate with respect to frequency and voltage level and low in harmonic distortion.

b. The equipment may be used for the following:

(1) Making voltage gain tests in wide-band audio amplifiers.
(2) Checking frequency response of wide-band audio amplifiers.
(3) Measuring distortion in wide-band audio amplifiers.
(4) Modulating r-f (radio-frequency) oscillators.
(5) Checking equipment operating at supersonic frequencies

4. Technical Characteristics

Frequency range	20 to 200,000 cps.
Calibration of tuning dial.	20 to 200.
Bands:	
X1	20 to 200 cps.
X10	200 to 2,000 cps.
X100	2,000 to 20,000 cps.
X1000	20,000 to 200,000 cps.
Output impedance	1,000 ohms.
Frequency response (reference level = 400 cps, 10 volts into 1,000-ohm load):	
20 cps	Approx ± 1 db (decibel).
150,000 cps	Approx ± 1 db.
Frequency accuracy	± 6%.
Frequency stability	± 2%.
Distortion (rated output).	Less than 3% at all frequencies.
Hum	60 db below rated output.

Attenuator accuracy---± 3% (except 10-microvolt range where accuracy is + 2 or —3 microvolts).
Power input----------115 volts, 50 to 1,600 cps.
Power output----------100 mw (milliwatts).
Fuse rating----------2 amperes.
Number of tubes------9.

5. Packaging Data

When packaged for export shipment, Audio Oscillator TS–382A/U is placed within its carrying Case CY–688/U (fig. 3) which is then sealed in a moistureproof-vaporproof container and packed in a wooden export crate. A cutaway view of typical packaging for export is shown in figure 2. The dimensions of the oscillator and its packaging is shown in the chart below.

Note. Items may be packaged in a manner different from that shown, depending on the supply channel.

Item	Height (in.)	Width (in.)	Depth (in.)	Volume (cu ft)	Weight (lb)
Audio Oscillator TS–382A/U	10	18¾	12¾	1.09	45
Case CY–688/U	17	19	17½	3.28	33
Crate--------	20	22	20½	5.15	95
Total					173

NOTE: FOLLOW PROCEDURE OUTLINED IN STEPS 1 THROUGH 5 ONLY FOR DOMESTIC SHIPMENTS. ADD STEPS 7 AND 8 FOR OVERSEAS SHIPMENTS.

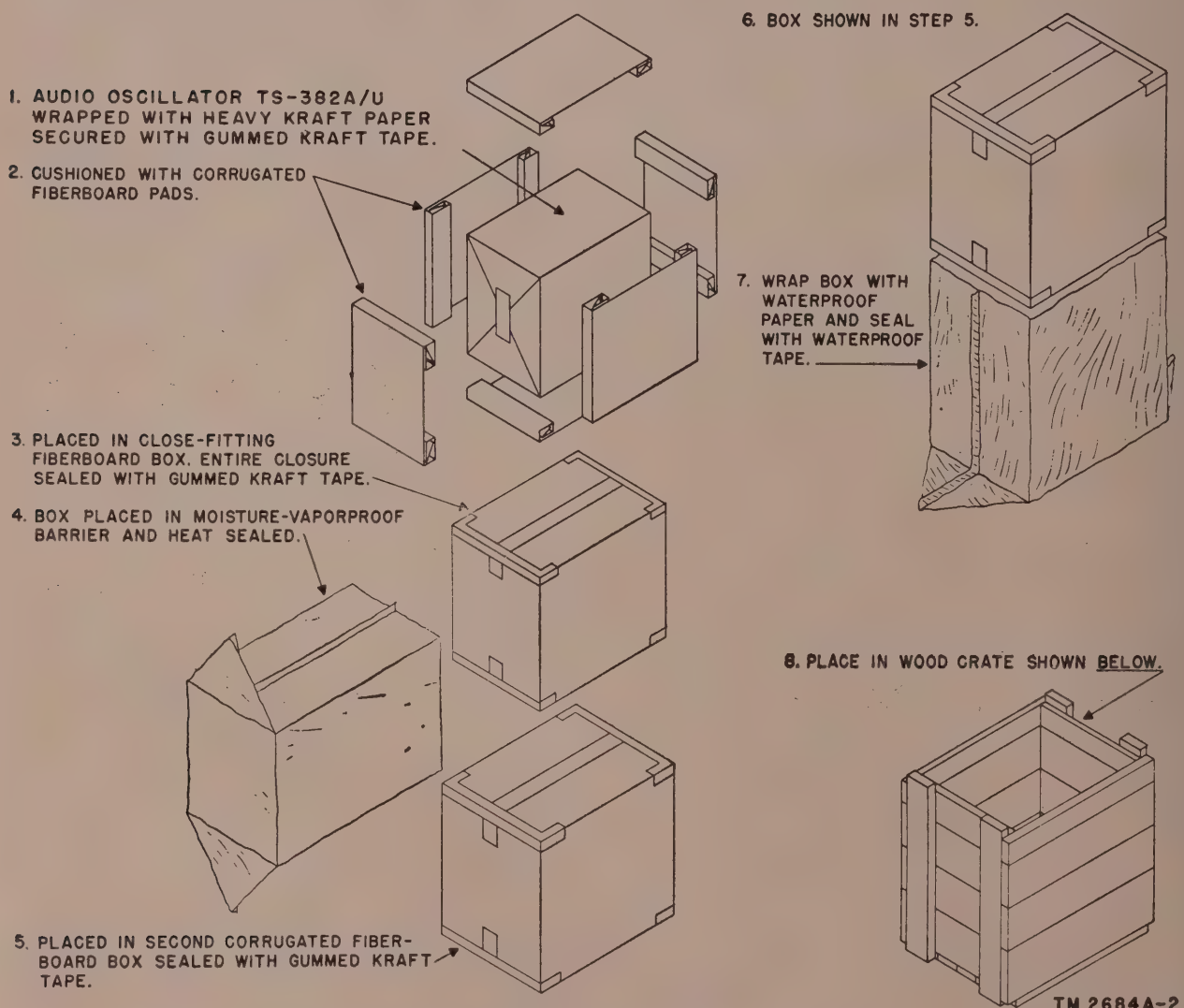

1. AUDIO OSCILLATOR TS-382A/U WRAPPED WITH HEAVY KRAFT PAPER SECURED WITH GUMMED KRAFT TAPE.
2. CUSHIONED WITH CORRUGATED FIBERBOARD PADS.
3. PLACED IN CLOSE-FITTING FIBERBOARD BOX. ENTIRE CLOSURE SEALED WITH GUMMED KRAFT TAPE.
4. BOX PLACED IN MOISTURE-VAPORPROOF BARRIER AND HEAT SEALED.
5. PLACED IN SECOND CORRUGATED FIBERBOARD BOX SEALED WITH GUMMED KRAFT TAPE.
6. BOX SHOWN IN STEP 5.
7. WRAP BOX WITH WATERPROOF PAPER AND SEAL WITH WATERPROOF TAPE.
8. PLACE IN WOOD CRATE SHOWN BELOW.
TM 2684A-2

Figure 2. Packaging of Audio Oscillator TS–382A/U.

6. Table of Components
(fig. 3)

Component	Quantity	Dimensions (in.)	Volume (cu ft)	Weight (lb)
Audio Oscillator TS–382A/U.	1	10 x 18¾ x 12¾	1.09	45
Cord CG–409A/U	1	5 feet		
Cord CX–237A/U	1	5 feet		
Adapter Connector UG–514/U.	1			
Dummy Load DA–35/U.	1			
Case CY–688/U	1	17 x 19 x 17½	3.28	33
Technical Manual TM 11–2684A.	2	11 x 1 x 8½	.05	1
Total				79

Note. This list is for general information only. See appropriate supply publications for information pertaining to requisition of spare parts.

7. Description of Audio Oscillator TS–382A/U

a. Audio Oscillator TS–382A/U is a nine-tube audio oscillator designed to operate over the range of 20 to 200,000 cps. The front panel (fig. 5) contains a calibrated tuning dial, a frequency RANGE switch, an OUTPUT LEVEL control, an output level ATTENUATOR, a power input jack, and a signal OUTPUT jack. There is a THERMOSTAT control to adjust the operating or stand-by temperature of the equipment. In the upper right corner of the front panel is an output level meter, and in the upper left corner is a vibrating reed-type meter used as an accurate check of the oscillator calibration. LINE and HEATER fuses and SPARE fuses are on the lower left corner of the front panel, along with the OSC. ON-OFF and HEATER ON-OFF switches and pilot lights.

b. In Case CY–688/U are eight rubber shock mountings on which the oscillator is mounted in storage or transit. Two banana-plug receptacles are mounted in the bottom of the transit case for storage of Dummy Load DA–35/U and Adapter Connector UG–514/U. Space is provided in the bottom of the transit case for the storage of the associated cords, spare tubes, spare fuses, spare lamps, and thermistor bulbs.

Figure 3. Components of Audio Oscillator TS–382A/U.

There is a rack on one side of the case for storage of technical manuals.

8. Running Spares

The running spares supplied with each Audio Oscillator TS–382A/U are stored in the bottom of Case CY–688/U. Spares are provided for all normally expendable items such as tubes, pilot lamps, and fuses. Following is a list of running spares:

2 tubes type 6SJ7.
1 tube type 5Y3GT/G.
1 tube type 6J5.
1 tube type 6SQ7.
1 tube type 6AG7.
1 tube type 6Y6G.
1 tube type 6V6.
1 tube type OA3.
10 fuses, 3AG, 2 amperes.
4 lamps, 6-8 volts, .15 ampere.
2 lamps, 3 watts, 110 volts.

CHAPTER 2

OPERATION INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF AUDIO OSCILLATOR TS–382A/U

9. Uncrating, Unpacking, and Checking New Equipment

Note. For used or reconditioned equipment, refer to paragraph 12.

a. General. Equipment may be shipped in export packing cases or in domestic packing cases. When new equipment is received, select a location where the equipment may be unpacked without exposure to the elements and which is convenient to the permanent or semipermanent installation of the equipment. The instructions in *b* below apply to equipment packed in export packing cases, and the instructions in *f* below apply to equipment shipped in domestic packing cases. Aside from checking to see that all components are present and undamaged, no special unpacking procedures are necessary for equipment shipped in carrying Case CY–688/U.

Caution: Be careful in uncrating, unpacking, and handling the equipment; it is easily damaged. If it is damaged or exposed, a complete overhaul might be required or the equipment might be rendered useless.

b. Step-by-Step Instructions for Uncrating and Unpacking Export Shipments (fig. 2).

(1) Place the packing crate as near the operating position as convenient.
(2) Cut and fold back the metal straps.
(3) Remove the nails with a nail puller. Remove the top and one side of the packing case. Do not attempt to pry off the sides and top; the equipment might become damaged.
(4) Remove the waterproof container or the moistureproof barrier and any excelsior or corrugated paper covering the equipment inside the crate. See *d* below for instructions on removing waterproof metal containers.
(5) Remove the equipment from its carrying case and place it on a workbench or near its final location.
(6) Inspect the equipment for possible damage incurred during shipment.
(7) Check the contents of the carrying case against the list of components on the case cover.

c. Opening Cardboard Carton and Waterproof Barrier. No special instructions are necessary for opening the waterproof barrier and removing the equipment from the cardboard carton.

d. Instructions for Opening Metal Containers. The top of the metal container is soldered to the sides. To open, break the soldered seam by prying the side of the container away from the seam as follows:

(1) Wipe off the excess solder with a soldering iron. Never use a torch because the contents of the container are inflammable.
(2) Pry the sides from the soldered seam with a wooden block or screw driver.
(3) When the seam is completely open, pry off the cover.
(4) Remove the bags of desiccant and the protective cardboard packing and lift or draw out the packages within.

e. Checking. Check the contents against the master packing slip.

f. Unpacking Domestic Packing Cases. Equipment may be received in domestic packing cases. The instructions in *b* above apply also to unpacking domestic packing cases. Cut the metal bands. Open the cartons that protect

the equipment. If heavy wrapping has been used, remove it carefully and take out the contents. Check the contents against the master packing slip.

Note. Save the original packing cases and containers for export and domestic shipments. They can be used again when the equipment is repacked for storage or shipment.

10. Siting

Place the oscillator within 5 feet of the external power source and as close as possible to the equipment being tested. The dimensions of the oscillator (par. 5) indicate the space required for installing the equipment in its operating position.

11. Installation of Equipment

The following is a list of the steps to be taken in the installation of the equipment.

a. Check the contents of Case CY–688/U against the list of components on the case lid.

b. Thoroughly inspect the exterior of the oscillator and other components for damage incurred in shipment.

c. Loosen the six knurled screws on the front panel and, with the handles on either side of the panel, lift the oscillator chassis from its cabinet.

d. Inspect the oscillator chassis for broken or improperly seated tubes.

e. Inspect the wiring for loose connections and defective parts.

f. Inspect the unit subassemblies to make certain they are securely fastened in place.

g. Check the rating and condition of the power and heater fuses.

h. Replace the oscillator chassis in its cabinet and tighten the knurled screws.

Caution: The chassis of the audio oscillator has been moistureproofed and fungiproofed. *Do not remove any of the protective coating.*

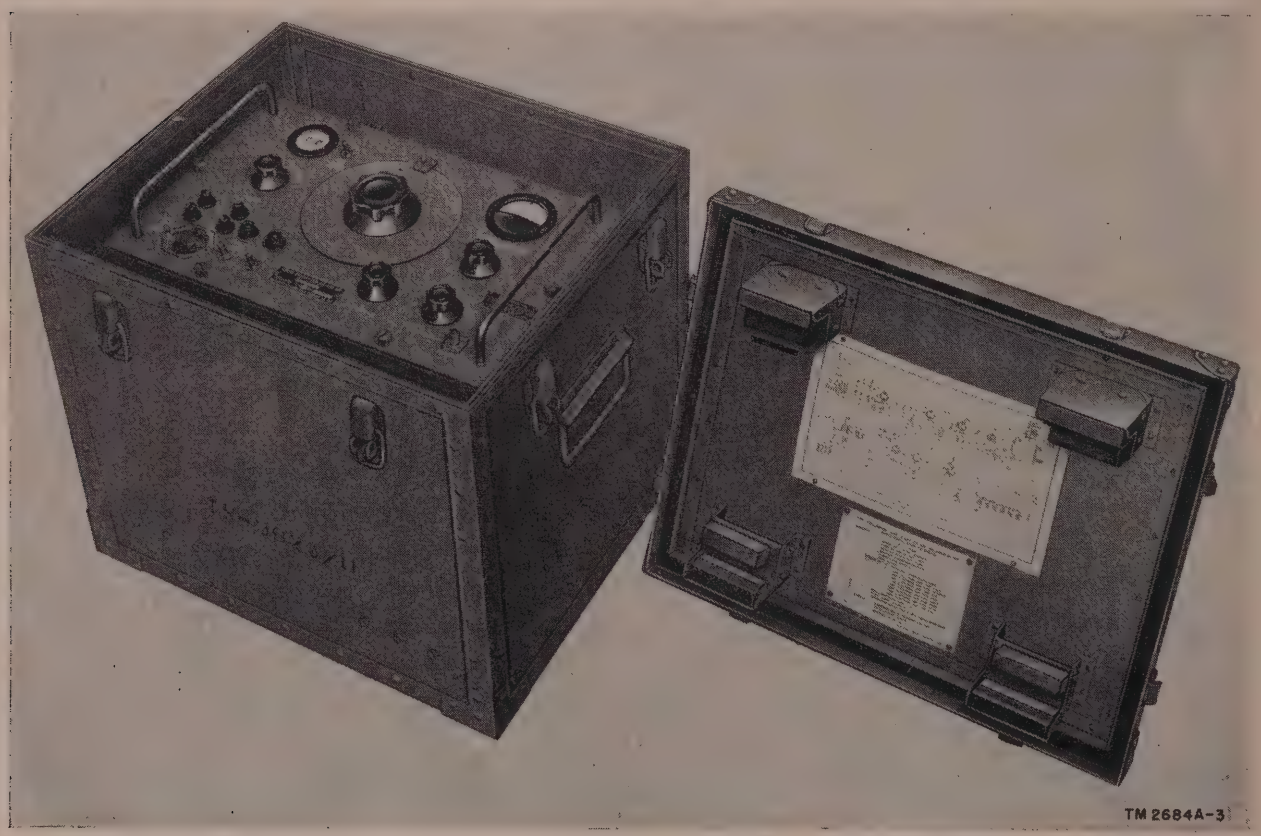


Figure 4. Audio Oscillator TS–382A/U in Case CY–688/U.

DEPARTMENT OF THE ARMY TECHNICAL MANUAL
DEPARTMENT OF THE AIR FORCE TECHNICAL ORDER
AUDIO OSCILLATOR TS-382A/U, TS-382B/U, and TS-382D/U

TM 11-2684A
TO 16-35TS312-16
Changes No. 1

DEPARTMENTS OF THE ARMY AND
THE AIR FORCE
WASHINGTON 25, D. C., *13 December, 1954*

TM 11-2684A/TO 16-35TS312-16, 9 May 1952, is changed as follows:

The title of the manual is changed to read:

AUDIO OSCILLATORS TS-382A/U, **TS-382B/U, AND TS-382D/U.**

1. Scope

This manual contains * * * Audio Oscillator TS-382A/U (fig. 1). **The information contained herein also applies to Audio Oscillator TS-382B/U and Audio Oscillator TS-382D/U, both of which were procured later. These later equipments, although having minor component changes, have the same technical characteristics as the earlier model. Audio Oscillator TS-382D/U is shown in figure 1.1; Audio Oscillator TS-382B/U is the same in appearance, with the sole exception that it does not have the external thermostat control.** In addition to these instructions, there **is an appendix covering a list of references.**

8. Running Spares

The running spares * * * lamps, and fuses. **The running spares supplied with Audio Oscillator TS-382B/U and TS-382D/U are the same as those supplied for the model A, with the exception that for model D, a 6SL7-GT is substituted for the 6SQ7.** Following is a * * * 2 lamps, 3 watts, 110 volts.

8.1 Differences in Models

(Added)

a. There are two other models of this audio oscillator; one designated TS-382B/U and the other TS-382D/U. They are similar in outward appearance to the original TS-382A/U, and have the same operating capabilities; only certain components have been changed. The table below shows these component variations. While studying this comparative list, reference to figure 24.1 will be helpful.

Item	Model TS-382A/U	Model TS-382B/U	Model TS-382D/U
R104	8.3K	8.55K	8.55K
R105	8.1K	8.35K	8.35K
R139	3.9K	9.8K	9.8K
L101	20H	28H	28H
V107	6SQ7	6SQ7	6SL7-GT

b. Several design changes have been made which apply to both models B and D.

(1) In the frequency meter circuit, R160 and R161 have been replaced by CR104 and CR103, respectively.

(2) The heater supply portion of the secondary of T101 is center tapped; terminal 12 is grounded.

14. Controls and Instruments

* * * * *

c. (Added) At first glance the panel of Oscillator TS-382D/U (fig. 5.1) appears to be the same as the panel of model A, but note that it does not have an external thermostat control. Instead, the thermostat control is inside (fig. 16.1). Model B, however, does have an external thermostat control, and is quite similar to model D and model A in appearance. All the other controls for model B and model D are the same as for model A.

Figure 1.1 (Added) *Audio Oscillator TS–382D/U.*

43. Trouble-shooting Data

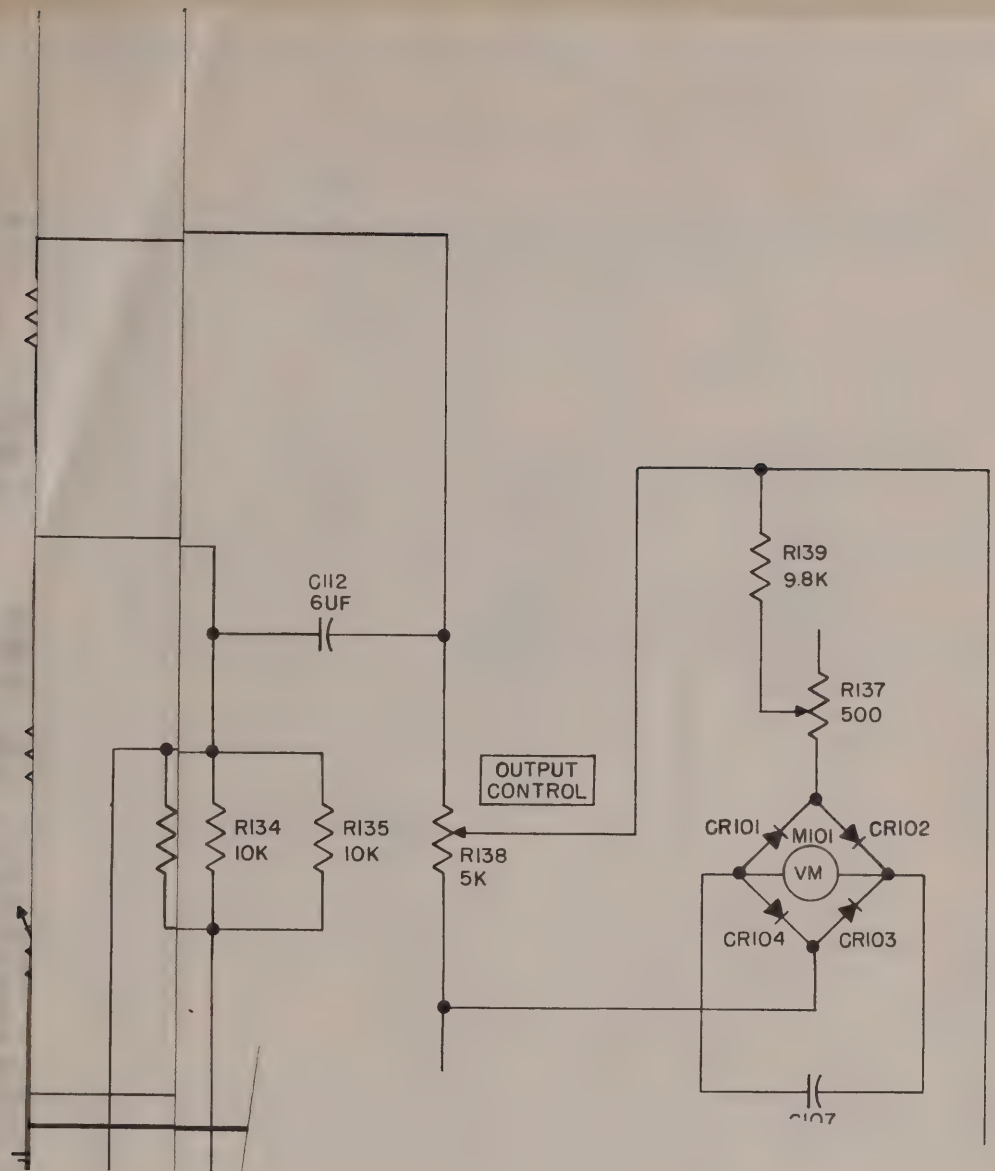
Take advantage of * * * trouble-shooting data.

Fig. or par. No.	Description
* * *	* * *
Fig. 15.1	**Audio Oscillator TS–382D/U, location of parts, top view.**
Fig. 16.1	**Audio Oscillator TS–382D/U, location of parts, bottom view.**
	Note. Figures 15.1 and 16.1 also apply for Audio Oscillator TS–382B/U.

43.1 Tube Socket Voltages and Resistances (Added)

The voltage table gives the normal ac and dc voltages for Audio Oscillator TS–382B/U and for Audio Oscillator TS–382D/U. The resistance table also indicates the correct resistance for both models when operating properly. The voltages and resistances listed in the tables are based on the following operating conditions:

Line voltage	115 volts
Power frequency	60 cps
OSC. ON-OFF switch	On
HEATER ON-OFF switch	Off
RANGE switch	X10
ATTENUATOR switch	X10
OUTPUT LEVEL control	To produce 10 volts
FREQ. METER switch	On
MAIN TUNING dial	40


C112
6UF
R139
9.8K
R137
500
OUTPUT
CONTROL
R134
10K
R135
10K
R138
5K
CR101
M101
CR102
VM
CR104
CR103
C107

the equipment. If heavy wrapping has been used, remove it carefully and take out the contents. Check the contents against the master packing slip.

Note. Save the original packing cases and containers for export and domestic shipments. They can be used again when the equipment is repacked for storage or shipment.

10. Siting

Place the oscillator within 5 feet of the external power source and as close as possible to the equipment being tested. The dimensions of the oscillator (par. 5) indicate the space required for installing the equipment in its operating position.

11. Installation of Equipment

The following is a list of the steps to be taken in the installation of the equipment.

a. Check the contents of Case CY–688/U against the list of components on the case lid.

b. Thoroughly inspect the exterior of the oscillator and other components for damage incurred in shipment.

c. Loosen the six knurled screws on the front panel and, with the handles on either side of the panel, lift the oscillator chassis from its cabinet.

d. Inspect the oscillator chassis for broken or improperly seated tubes.

e. Inspect the wiring for loose connections and defective parts.

f. Inspect the unit subassemblies to make certain they are securely fastened in place.

g. Check the rating and condition of the power and heater fuses.

h. Replace the oscillator chassis in its cabinet and tighten the knurled screws.

Caution: The chassis of the audio oscillator has been moistureproofed and fungiproofed. *Do not remove any of the protective coating.*

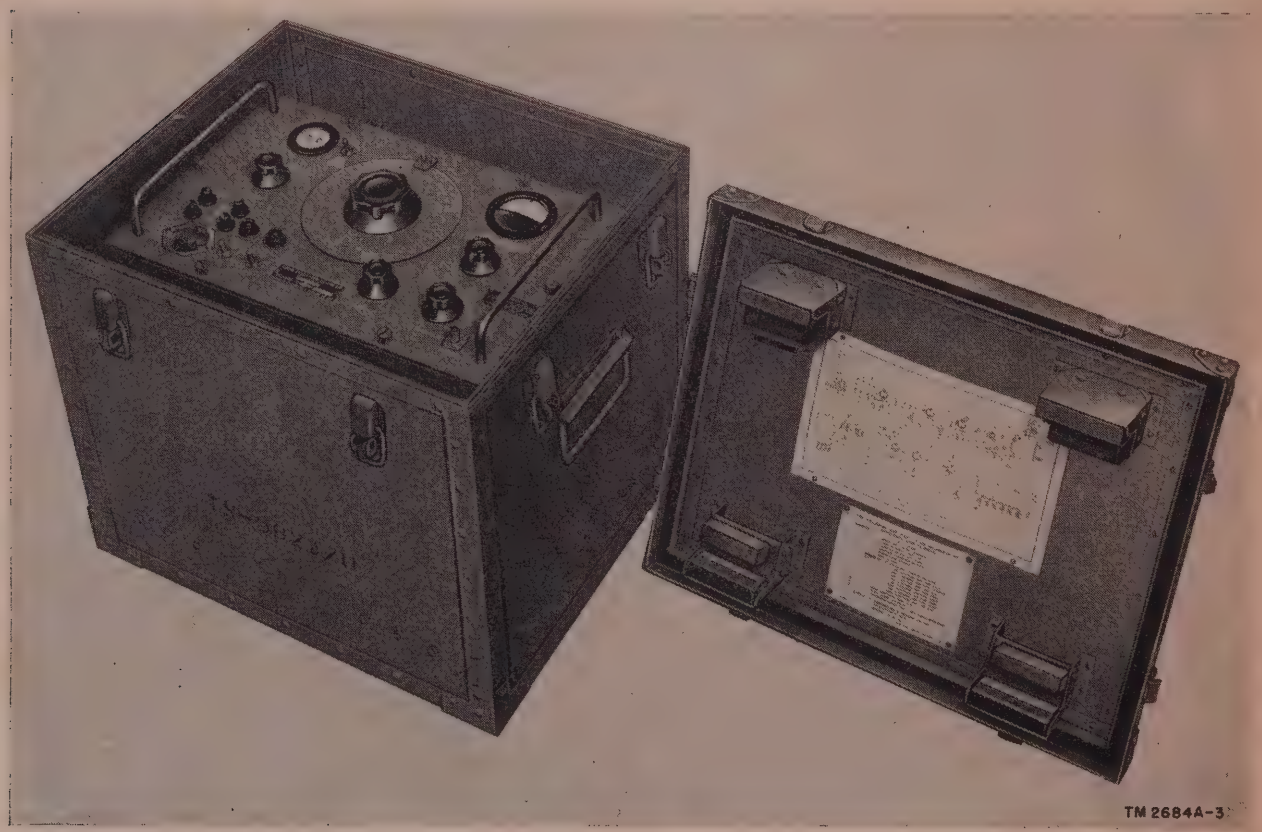


Figure 4. Audio Oscillator TS–382A/U in Case CY–688/U.

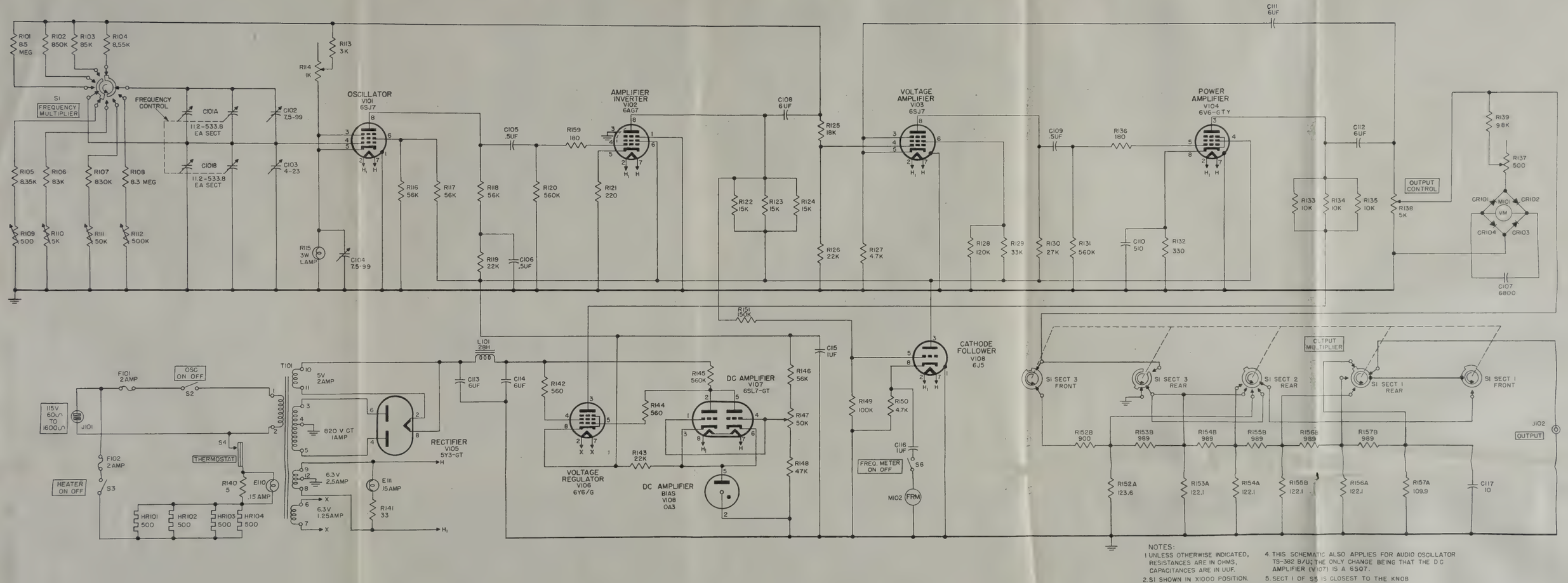


Figure 24.1 (Added) *Audio Oscillator TS-382D/U, complete schematic.*

NOTES:
1. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN UUF.
2. S1 SHOWN IN X1000 POSITION.
3. S5 SHOWN IN .00001 POSITION.
4. THIS SCHEMATIC ALSO APPLIES FOR AUDIO OSCILLATOR TS-382 B/U; THE ONLY CHANGE BEING THAT THE D.C AMPLIFIER (V107) IS A 6SQ7.
5. SECT I OF S5 IS CLOSEST TO THE KNOB
6. ▭ INDICATES EQUIPMENT MARKING.

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12. Service Upon Receipt of Used or Reconditioned Equipment

a. Follow the instructions in paragraph 9 for uncrating, unpacking, and checking the equipment.

b. Check the used or reconditioned equipment for tags or other indications that the wiring has been changed. If any wiring changes have been made, note the changes in this manual, preferably on the schematic diagram.

Section II. CONTROLS AND INSTRUMENTS

13. General

Haphazard operation or improper setting of the controls can cause damage to electronic equipment. For this reason, it is important to know the function of every control. The actual operation of Audio Oscillator TS–382A/U is discussed in paragraphs 15–17.

14. Controls and Instruments

a. The following chart lists the controls of the oscillator and their functions.

Control	Function
HEATER ON-OFF switch, S3	ON position: Connects heating elements to power source. OFF position: Cuts off power to heating element.
THERMOSTAT, S4	Rotation of this control in the clockwise direction will increase the temperature at which the heating elements will maintain the oscillator.

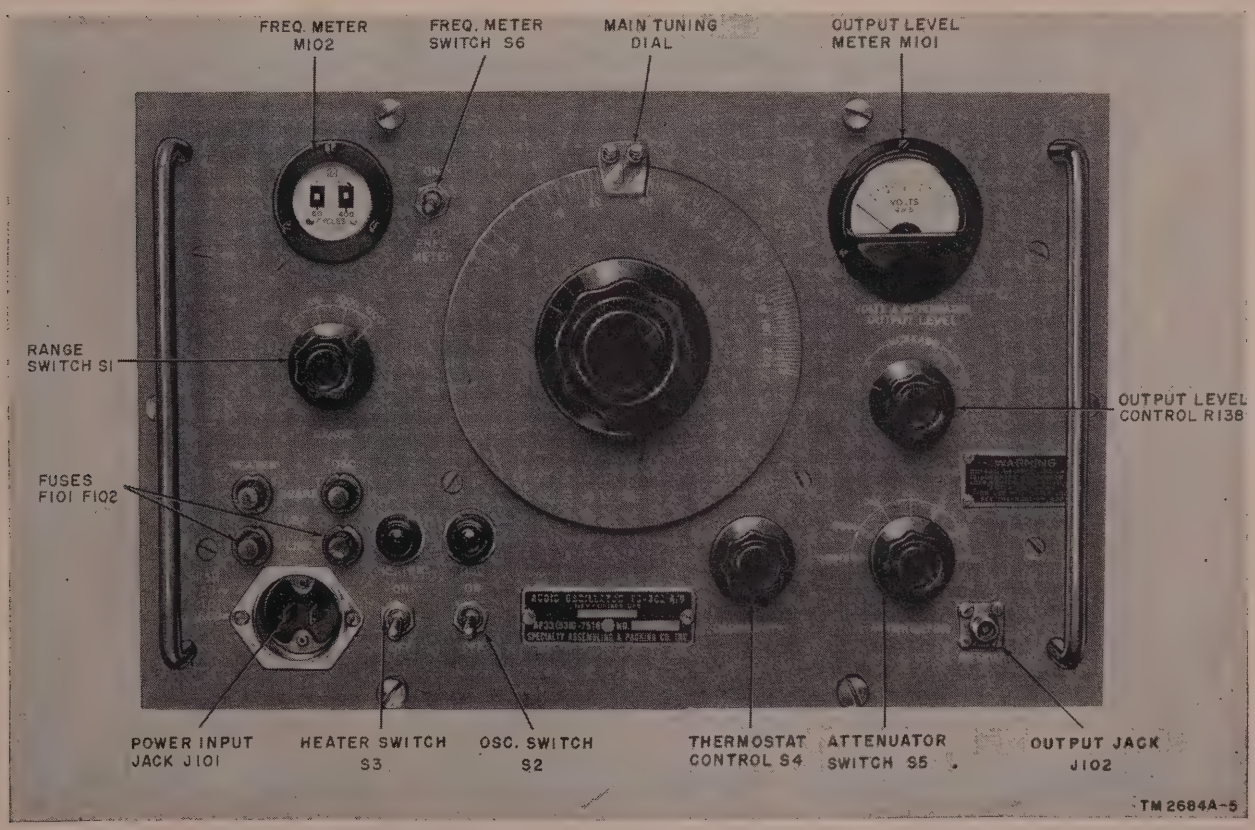


Figure 5. Controls and instruments.

Control	Function
HEATER pilot lamp	Indicates when heating elements are on.
OSC. ON-OFF switch, S2	ON position: Connects power to the oscillator. OFF position: Cuts off power to the oscillator.
OSC. pilot lamp	Indicates when power is applied to the oscillator.
RANGE switch, S1	Determines the output frequency range.
Tuning dial	The dial reading multiplied by the RANGE switch setting indicates the frequency of the oscillator output.
OUTPUT LEVEL control, R138	Rotation of this control in the clockwise direction will increase the amplitude of the output signal from zero volts to the maximum permitted by the ATTENUATOR switch setting.
ATTENUATOR switch, S5	Determines the range over which the amplitude of the output signal may be varied by the OUTPUT LEVEL control.
FREQ. METER ON-OFF switch, S6	ON position: Applies oscillator signal to the FREQ. METER. OFF position: Cuts the FREQ. METER out of circuit.

b. The following chart lists the instruments of the oscillator and indicates their functions.

Instruments	Function
OUTPUT LEVEL METER	Indicates the voltage level of the oscillator output signal when the meter reading is multiplied by the setting of the ATTENUATOR switch.
FREQ. METER	The FREQ. METER is used to check the calibration of the tuning dial and/or the frequency of the output signal. Checks can be made at 60 cps or 400 cps.

Section III. OPERATION UNDER USUAL CONDITIONS

15. Starting Procedure

Perform the starting procedure given below before using the operating procedure described in paragraph 16.

a. Plug the power cable, Cord CX–237A/U, into the power input receptacle, J101.

b. Attach the output cable, Cord CG–409 A/U, to the OUTPUT plug, J102.

c. Turn the HEATER ON-OFF switch to the OFF position.

d. Turn the OSC. ON-OFF switch to the OFF position.

e. Plug the power cable into a 115-volt source, 50 to 1,600 cycles.

f. Turn the OSC. ON-OFF switch to the ON position; the OSC. pilot lamp should light.

g. Allow the oscillator to warm up for 15 minutes.

h. At low ambient temperatures, proceed as follows:

(1) Turn the HEATER ON-OFF switch to the ON position.

(2) Turn the THERMOSTAT control knob fully clockwise; the HEATER pilot lamp should light.

(3) When the case of the oscillator feels warm to the touch, turn the THERMOSTAT control knob in the counterclockwise direction until the HEATER pilot lamp just goes out, and leave it in this position.

(4) Leave the HEATER ON-OFF switch in the ON position.

i. Check to see that the oscillator is operating properly, following the procedure below:

(1) Set the main tuning dial at 60.

(2) Set the RANGE switch at X1 (the lowest frequency range).

(3) Turn the FREQ. METER switch to the ON position.

(4) Move the main tuning dial back and forth slightly until the FREQ. METER reed marked 60 CYCLES PER SECOND vibrates with maximum amplitude. The setting of the main

tuning dial at this point should be within 1 division of 60.

(5) Make the same check at 400 cps. The main tuning dial should be within 1½ divisions of 40 (with the RANGE switch set at X10) when the FREQ. METER reed marked 400 CYCLES PER SECOND vibrates with maximum amplitude.

(6) If the dial settings for maximum reed vibration do not fall into the tolerances indicated above, refer to paragraph 52 for corrective measures.

(7) Turn the FREQ. METER switch to the OFF position at the completion of this check.

16. Operating Procedure

a. General. Follow the instructions in paragraph 15 for starting, warming up, and checking Audio Oscillator TS–382A/U.

b. Output Connections. The signal output is taken from the oscillator at the OUTPUT jack on the lower right-hand side of the front panel (fig. 5). The output cable, Cord CG–409A/U, may be used with either Adapter Connector UG–514A/U for loads of approximately 1,000 ohms, or with Dummy Load DA–35/U, marked 1,000 OHM LOAD, for high impedances. Use of the dummy load with high-impedance external loads maintains the accuracy of the metering circuit calibration.

c. Selecting Frequency. Any frequency from 20 to 200,000 cps may be selected by setting the main tuning dial and the RANGE switch so that the two settings, when multiplied together, equal the desired output frequency. For example, to select an output frequency of 52,000 cps, set the main tuning dial to 52 and the RANGE switch to X1000.

Caution: Do not force the main tuning dial beyond its normal travel; this may destroy the calibration of the instrument.

d. Selecting Output Voltage. Select voltages from 0 to 10 volts by using the OUTPUT LEVEL control in conjunction with the ATTENUATOR switch. The ATTENUATOR is calibrated in seven decade steps so that with the OUTPUT LEVEL meter set at 1 volt by the OUTPUT LEVEL control, output voltages of 10 volts to 10 microvolts can be obtained by switching the ATTENUATOR setting. For intermediate values of output voltage, the OUTPUT LEVEL control is varied so that the OUTPUT LEVEL meter reads the desired voltage. The ATTENUATOR switch is then set so that its value, multiplied by the meter reading, gives the desired output voltage level. For example, to obtain an output voltage of .04 volt, set the meter by means of the OUTPUT LEVEL control to read .4 volt, and set the ATTENUATOR switch to the .1 position. The output voltage then will be the meter reading multiplied by the ATTENUATOR setting, or .04 volt.

Caution: The calibration of the attenuator network is accurate only when the instrument is working into its rated load of 1,000 ohms. Therefore, it is necessary to use the dummy load when working into high impedances.

17. Stopping Procedure

a. Turn the OSC. ON-OFF and the HEATER ON-OFF switches to the OFF position.

b. Disconnect the output cable.

c. Disconnect the power input cable from the 115-volt source and then from the front panel power receptacle.

d. Place the cables, dummy load, connector adapter, and the oscillator in Case CY–688/U for storage.

Section IV. OPERATION UNDER UNUSUAL CONDITIONS

18. General

The operation of Audio Oscillator TS–382A/U may be difficult in regions where extreme cold, heat, humidity and moisture, sand conditions, etc., prevail. Instructions on procedures for minimizing the effect of these unusual operating conditions are given in paragraphs 19–21.

19. Operation in Arctic Climates

Subzero temperatures and climatic conditions associated with cold weather affect the efficient

operation of the equipment. Instructions and precautions for operation under such adverse conditions follow:

a. Handle the equipment carefully.

b. Keep the equipment warm and dry. If the oscillator is not in a heated inclosure, keep the heating elements turned on.

c. Locate the equipment where there is no danger of a cold draft striking the glass tubes when a door is opened. A sudden draft of cold air is often sufficient to shatter the glass envelope of a heated tube. If the inclosure is constructed so that this precaution is impossible, place a blanket or some barrier between the source of the draft and the equipment.

d. When equipment which has been exposed to the cold is brought into a warm room, it will start to sweat and will continue to do so until it reaches room temperature. When the equipment reaches room temperature, dry it thoroughly. This condition also arises when equipment warms up during the day after exposure during a cold night.

20. Operation in Tropical Climates

Moisture conditions are more acute than normal in the tropics. When the equipment is located in a poorly ventilated location, the high relative humidity causes condensation of moisture on the equipment whenever the temperature of the equipment becomes lower than that of the ambient air. To minimize this condition, keep the heater resistors turned on, with the THERMOSTAT control set at a point that keeps the oscillator case warm to the touch.

21. Operation in Desert Climates

a. The main problem which arises with equipment operation in desert areas is the large amount of sand or dust and dirt which enters the moving parts of electronic equipment. The ideal preventive precaution is to house the equipment in dustproof inclosures. Since such a building is seldom available and would require air conditioning, the next best precaution is to make the building in which the equipment is located as dustproof as possible. Hang wet sacking over the windows and doors, cover the inside walls with heavy paper, and secure the side walls of tents with sand to prevent their flapping in the wind.

b. Never tie power cords, cables, or other wiring connections to either the inside or outside of tents. Desert areas are subject to sudden wind squalls which may jerk the connections loose or break the lines.

c. Take care to keep the equipment as free from dust as possible. Make frequent preventive maintenance checks (pars. 22–33).

CHAPTER 3
ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. ORGANIZATIONAL MAINTENANCE TOOLS AND EQUIPMENT

22. General

When performing preventive maintenance on Audio Oscillator TS–382A/U, tools and materials similar to those listed in paragraph 23 will be required.

23. Tools and Materials

The following tools and materials are required for organizational maintenance.

a. Tools.
Tool Equipment TE–113 (or equal)

b. Materials.
Orangestick
Cheesecloth, bleached, lint-free
Carbon tetrachloride
Paper, sand, flint, No. 000
Solvent, dry-cleaning (SD) (Fed spec No. P–S–661a)
Part of Tool Equipment TE–41.

Section II. PREVENTIVE MAINTENANCE SERVICE

24. Definition of Preventive Maintenance

Preventive maintenance is work performed on equipment (usually when the equipment is not in use) to keep it in good working order so that breakdowns and needless interruptions in service will be kept to a minimum. Preventive maintenance differs from trouble shooting and repair since its object is to prevent certain troubles from occurring. See AR 750–5.

25. General Preventive Maintenance Techniques

a. Use No. 0000 sandpaper to remove corrosion.

b. Use a clean, dry, lint-free cloth or a dry brush for cleaning.

(1) If necessary, except for electrical contacts, moisten the cloth or brush with solvent (SD); then wipe the parts dry with a cloth.

(2) Clean electrical contacts with a cloth moistened with carbon tetrachloride; then wipe them dry with a cloth.

c. If available, dry compressed air may be used at a line pressure not exceeding 60 pounds per square inch to remove dust from inaccessible places; be careful, however, or mechanical damage from the air blast may result.

d. For further information on preventive maintenance techniques, refer to TB SIG 178.

26. Performing Preventive Maintenance

The following preventive maintenance operations should be performed by organizational personnel at the intervals indicated, unless these intervals are reduced by the local commander:

Caution: Screws, bolts, and nuts should not be tightened carelessly. Fittings tightened beyond the pressure for which they are designed will be damaged or broken.

a. Daily. Clean exterior of cabinet and console.

b. Weekly.

Caution: Disconnect all power before performing the following operations. Upon completion, reconnect power and check for satisfactory operation.

(1) Clean interior of cabinet, exterior of all chassis, and all parts accessible without removal from cabinet.

(2) Inspect filter capacitors C113 and C114 for bulging and for heating.

(3) Inspect power transformer T101 for signs of excessive heating.
(4) Inspect fuses F101 and F102 and fuseholders for corrosion, cracks, and lack of tension sufficient to insure good contact.

c. Monthly. Make visual inspection of the following; tighten and/or clean *if necessary:*

(1) Tube sockets and pins, for loose contacts, dirt, and corrosion. Check vacuum tubes; replace if necessary (fig. 15). Note that tubes including final letters W or Y in their nomenclature can replace tubes of the same type; for example, JAN–6SJ7W can replace JAN–6SJ7.
(2) Capacitor terminals, for corrosion.
(3) Resistors, for blistering, discoloration, and other evidence of overheating.
(4) Switch S4, for dirt, corrosion, loose contacts, and unsatisfactory mechanical action.
(5) Connectors J101 and J102, for dirt, corrosion, and loose contacts.
(6) Wires, cords, cables, for cracked, cut, and frayed insulation.
(7) Terminal boards, for cracks, dirt, and loose connections.
(8) Mountings, machine screws, and nuts, for mechanical looseness.
(9) All visible terminals and connections, for loose connections and corrosion.
(10) MFP coatings, for breaks. (Retouch with a brush, if necessary.)
(11) Finish, for scratches and bare spots. (Retouch with a brush, if necessary.)
(12) Unshielded variable capacitors C101 through C104, for dirt, corrosion, and bent plates.
(13) Insulators, for cracks and dirt.

Section III. LUBRICATION AND WEATHERPROOFING

27. Lubrication

Audio Oscillator TS–382A/U requires no lubrication.

28. Weatherproofing

a. General. Signal Corps equipment, when operated under severe climatic conditions such as prevail in tropical, arctic, and desert regions, requires special treatment and maintenance. Fungus growth, insects, dust, corrosion, salt spray, excessive moisture, and extreme temperatures are harmful to most materials.

b. Tropical Maintenance. A special moistureproofing and fungiproofing treatment has been devised which, if properly applied, provides a reasonable degree of protection. This treatment is explained in TB SIG 13 and TB SIG 72.

c. Winter Maintenance. Special precautions necessary to prevent poor performance or total operational failure of equipment in extremely low temperatures are explained in TB SIG 66 and TB SIG 219.

d. Desert Maintenance. Special precautions necessary to prevent equipment failure in areas subject to extremely high temperatures, low humidity, and excessive sand and dust are explained in TB SIG 75.

e. Lubrication. The effects of extreme cold and heat on materials and lubricants are explained in TB SIG 69. Observe all precautions outlined in TB SIG 69 and pay strict attention to all lubrication orders when operating equipment under conditions of extreme cold or heat.

29. Rustproofing and Painting

a. When the finish on the case has been badly scarred or damaged, rust and corrosion can be prevented by touching up the bared surfaces. Use No. 00 or No. 000 sandpaper to clean the surface down to the bare metal; obtain a bright, smooth finish.

Caution: Do not use steel wool. Minute particles frequently enter the case and cause harmful internal shorting or grounding of circuits.

b. When a touch-up job is necessary, apply paint with a small brush. Remove rust from the case by cleaning corroded metal with solvent (SD). In severe cases, it may be necessary to use solvent (SD) to soften the rust and to use sandpaper to complete the preparation for painting. Paint used should be authorized and consistent with existing regulations.

Section IV. TROUBLE SHOOTING AT ORGANIZATIONAL MAINTENANCE LEVEL

30. Scope

The trouble shooting and repair work that can be performed at the organizational maintenance level (operators and repairmen) is necessarily limited in scope by the tools, test equipment, and replaceable parts issued, and by the existing tactical situation. Accordingly, trouble shooting is based on the performance of the equipment and the use of the senses in determining such troubles as burned-out resistors, cracked insulators, etc.

31. Visual Inspection

a. Failure of this equipment to operate properly usually will be caused by one or more of the following faults:

(1) Worn, broken, or disconnected power input cable.
(2) Burned-out fuses.
(3) Defective tubes.
(4) Burned insulators and resistors.
(5) Broken wiring.
(6) Loose terminal board connections.

b. When failure is encountered and the cause is not immediately apparent, check as many of the above items as is practicable before starting a detailed examination of the equipment. If possible, obtain information from the operator of the equipment regarding its performance at the time of failure.

32. Trouble Shooting by Using Equipment Performance Checklist

a. General. The equipment performance checklist (par. 33) will help the operator to locate trouble in the equipment. The list gives the item to be checked, the conditions under which the item is checked, the normal indications and tolerances of correct operation, and the corrective measures the operator can take. *To use this list, follow the items in numerical sequence.*

b. Action or Condition. For some items, the information given in the action or condition column consists of various switch and control settings under which the item is to be checked. For other items it represents an action that must be taken to check the normal indication given in the normal indications column.

c. Normal Indications. The normal indications listed include the visible and audible signs that the operator should perceive when he checks the items. If the indications are not normal, the operator should apply the recommended corrective measures.

d. Corrective Measures. The corrective measures listed are those the operator can make without turning in the equipment for repairs. A reference in the table to chapter 5 indicates that the trouble cannot be corrected during operation and that trouble shooting by an experienced repairman is necessary. If the set is completely inoperative or if the recommended corrective measures do not yield results, trouble shooting is necessary. However, if the tactical situation requires that communication be maintained, and if the set is not completely inoperative, the operator must maintain the set in operation as long as it is possible to do so.

33. Equipment Performance Checklist

	Item No.	Item	Action	Normal indication	Corrective measures
PREPARATORY	1	RANGE switch	X1.		
	2	Tuning dial	20		
	3	OUTPUT LEVEL control	Full counterclockwise.		
	4	ATTENUATOR switch	X1.		
	5	THERMOSTAT control	Full clockwise.		
	6	FREQ. METER ON-OFF switch.	ON.		

	Item No.	Item	Action	Normal indication	Corrective measures
EQUIP.	7	HEATER ON-OFF switch	ON, allow 15 minutes to warm up.	HEATER pilot lamp lights	Check power cable connections. Check pilot lamp. Check fuse F102.
	8	THERMOSTAT control	Rotate full counterclockwise.	HEATER pilot lamp goes out.	Check THERMOSTAT switch for frozen contacts.
PERFORMANCE	9	OSC. ON-OFF switch	ON	OSC. pilot lamp lights	Check fuse F101. Check pilot lamp.
	10	OUTPUT LEVEL control	Rotate clockwise then counterclockwise.	OUTPUT LEVEL meter indicates rise and fall of oscillator output.	Refer to chapter 5.
	11	Tuning dial	Move back and forth around 60.	FREQ. METER 60-cps reed vibrates.	Refer to chapter 5.
	12	RANGE switch	X10.		
	13	Tuning dial	Move back and forth around 40.	FREQ. METER 400-cps reed vibrates.	Refer to chapter 5.
STOP	14	OSC. ON-OFF switch	OFF.		
	15	HEATER ON-OFF switch	OFF.		

CHAPTER 4

THEORY

34. Block Diagram
(fig. 6)

Audio Oscillator TS–382A/U generates an audio signal with a range from 20 to 200,000 cps. The signal and feedback paths are shown in figure 6. A complete schematic diagram is shown in figure 24.

a. The oscillator consists of two stages, an oscillator stage and an amplifier inverter stage, which are connected to form a Wein-bridge oscillator. Part of the output of the amplifier inverter stage is fed back to the oscillator stage, and the remainder is amplified through V103 and V104. The output of amplifier V104 is passed through the attenuator section and then to the equipment OUTPUT jack.

b. The vibrating reed-type frequency meter is switched into the circuit when the oscillator calibration is checked. The frequency meter is fed from the amplifier inverter output through the isolation stage, cathode follower V108.

c. The output meter is connected between amplifier V104 and the attenuator section. It reads the volts output of amplifier V104, therefore the meter reading must be corrected by the attenuation factor of the attenuator. The correction consists of multiplying the meter reading by the ATTENUATOR control panel setting.

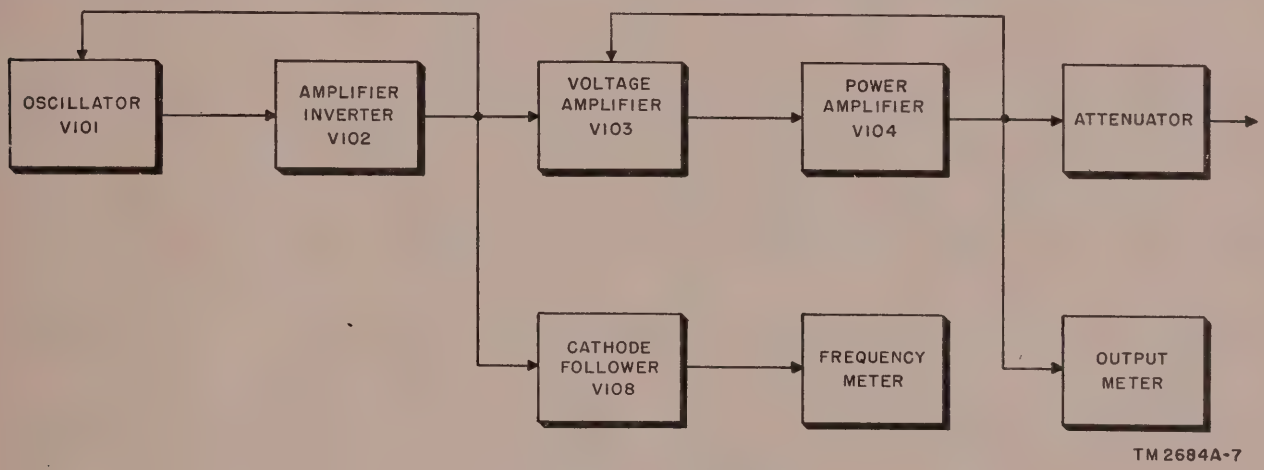


Figure 6. Block diagram.

35. Wein-Bridge Oscillator

The oscillator uses a frequency selective Wein-bridge circuit as the resistance-capaci-

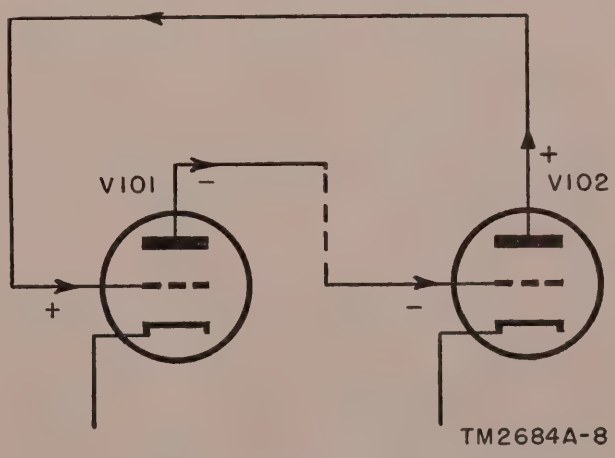


Figure 7. Fundamental feedback diagram.

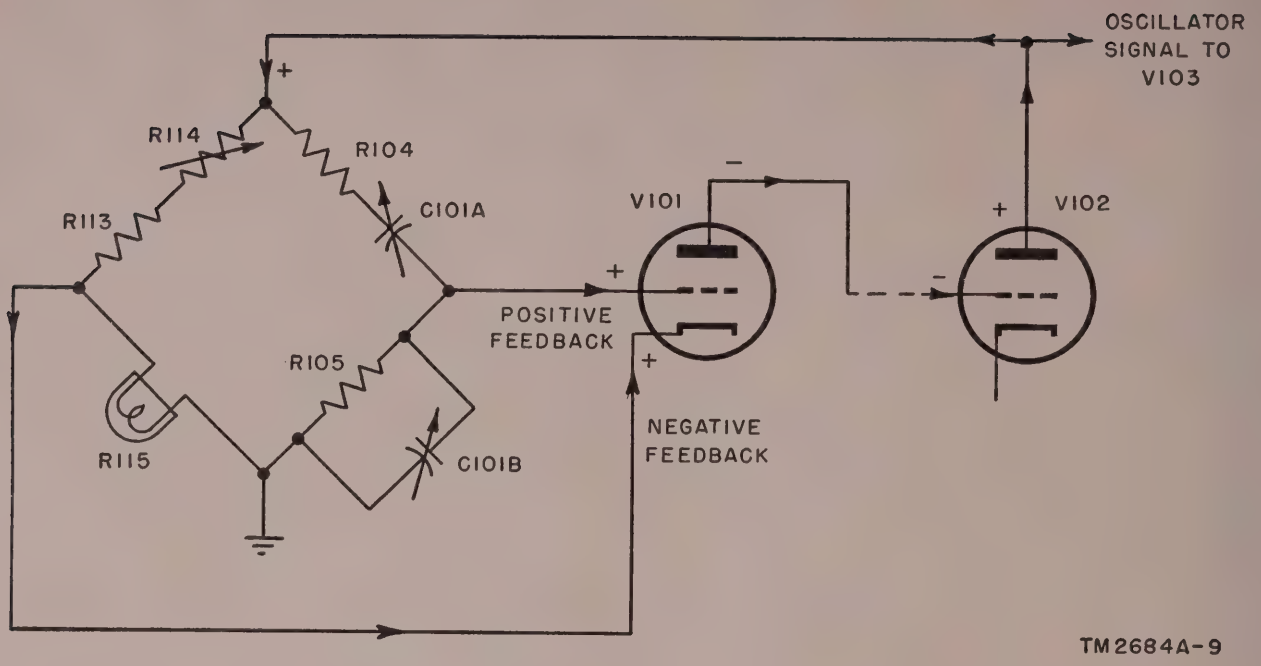


Figure 8. Positive and negative feedback from bridge.

tance feedback network. Figure 7 shows the fundamental positive feedback path. The negative feedback circuit is shown in figure 9. In figure 8, the feedback circuit shows that the phase shifting and feedback amplitude controlling element of the circuit is a frequency selective bridge.

a. Positive Feedback (fig. 7). Tube V101 is the oscillator tube. Tube V102 acts as an amplifier and inverter. Even without a bridge circuit, this system oscillates, since any signal that appears at the grid of V101 is amplified and inverted by both V101 and V102. The voltage fed back to the grid of V101 then must reinforce the initial signal, thus producing self-sustaining oscillation. However, such a system would oscillate at any and all frequencies uncontrollably. The introduction of a bridge circuit in the feedback path eliminates voltages of all frequencies except the single frequency desired in the output.

b. Negative Feedback (fig. 9). A degenerative feedback voltage is provided by taking a portion of the output from V102, from voltage dividers R113, R114, and lamp R115 and applying it to the cathode of tube V101. Since there is no phase shift across this voltage divider, and since it is purely resistive, the amplitude of the negative feedback voltage is constant for all frequencies. A curve of the negative feedback voltage is plotted in figure 10.

c. Bridge Circuit (fig. 8). The bridge allows a voltage of only one frequency to be effective in the oscillator circuit because of the degeneration and phase shift provided by it to other than the desired frequency. Oscillations can take place at the frequency f_o which permits the voltage across R105, the input signal to V101, to be in phase with the positive feedback output voltage of V102 and equal or greater than the constant negative feedback voltage. Voltages of other frequencies are shifted in phase between the plate of V102 and the grid of V101 and are attenuated by the high degeneration of the circuit so that oscillations cannot be maintained at a frequency other than f_o.

(1) The positive feedback voltage is provided by the voltage divider consisting of R104, C101A, R105, and C101B. If the frequency is high, the reactance of the capacitors is almost zero. In this case, R105 is shunted by a low reactance, making the voltage between the grid of V101 and ground almost zero. On the other hand, if the frequency is reduced toward zero, the current that can flow through either C101B or

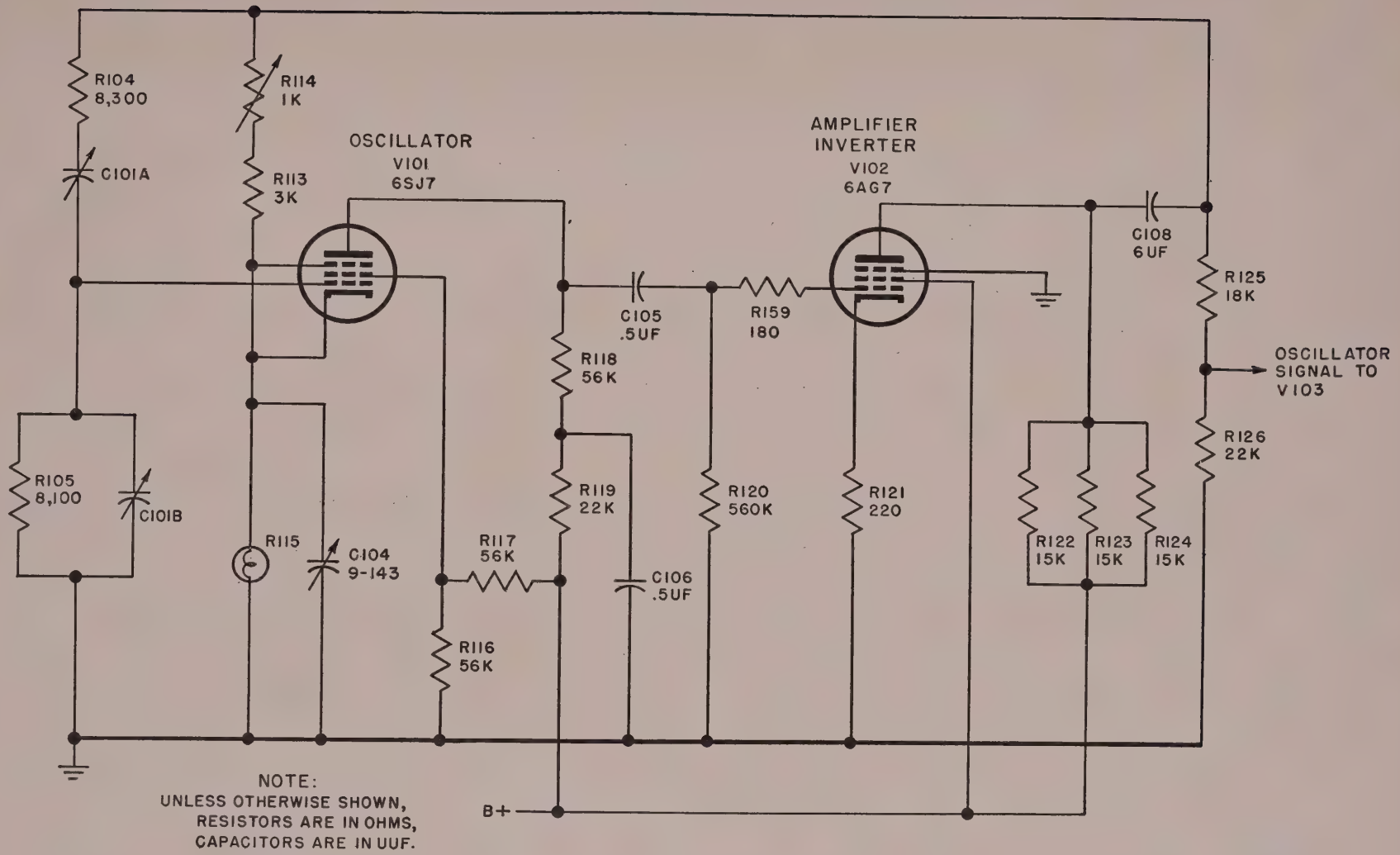


Figure 9. Wien-bridge oscillator.

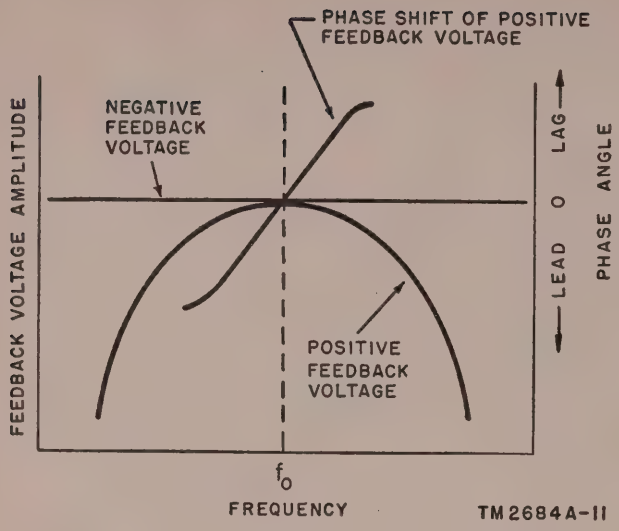


Figure 10. Curve of feedback and phase vs frequency.

R105 is reduced to almost zero by the high reactance of C101A. Therefore, the voltage between the grid of V101 and ground again falls almost to zero. At some intermediate frequency, the positive feedback voltage is a maximum, as shown by the curve in figure 10. The curve is rather flat in the vicinity of f_o, but the phase shift that occurs in the positive feedback circuit permits only one frequency to be generated.

(2) The voltage across R105 is in phase with the output voltage of V102 if the product of R104 and C101A equals the product of R105 and C101B. If the frequency of the output of V102 increases, the voltage across R105 tends to lag the voltage at the plate of V102. If the frequency decreases, the voltage across R105 leads the output voltage of V102. The phase angle between these two voltages is plotted against the frequency of the feedback voltage in figure 10.

(3) The frequency at which the circuit oscillates is:

$$f_o = \frac{1}{2\pi \sqrt{R104 \times C101A \times R105 \times C101B}}$$

$$f_o = \frac{1}{2\pi\, R104 \times C101A}.$$

At this frequency, the positive feedback voltage on the grid of V101 equals or barely exceeds the negative feedback voltage on the cathode, and is of the proper phase to sustain oscillation.

d. Components (fig. 9).

(1) Lamp R115, in the cathode of V101, stabilizes the amplitude of the oscillations. Any increase in the amplitude of the oscillations increases the current drawn through the lamp filament. The increased current drawn heats the filament, increasing its resistance, thus increasing the negative feedback applied to V101. The stage gain is reduced by the negative feedback and the stage output is brought back to its original amplitude. R113 and R114 form the remainder of the voltage divider of which lamp R115 is a part. R114 is adjustable, its position determining the stabilization point of the output of V101.

(2) The tuning dial is connected to four capacitors ganged together. C101A represents two of them connected in parallel and C101B represents the other two in parallel. C102 is the trimmer for C101A and C103 is the trimmer for C101B (fig. 24).

(3) RANGE switch S1 has two sections (fig. 24). One section determines which resistor (R101, R102, R103, or R104) is placed in series with C101A; the other section selects the parallel resistor (R105, R106, R107, or R108) for C101B.

(4) Resistor R118 is the plate load for V101, and R119 and C106 form a plate decoupling circuit. Screen voltage is obtained for V101 from the voltage divider consisting of R116 and R117. C104 is the cathode bypass capacitor for V101, and is made small (140 $\mu\mu$f (micromicrofarads) maximum) so that it effectively reduces the degeneration only in the higher frequency ranges. C105 couples the output of V101 to stage V102.

(5) The plate load for tube V102 consists of R121, R123, and R124 in parallel. The screen grid is directly connected

to B+. Cathode bias is developed across R121. The input signal for the stage is developed across R120. Resistor R159 is a parasitic suppressor.

36. Amplifier
(fig. 11)

a. General. The output section of the oscillator consists of a two-stage, resistance-coupled amplifier using tubes V103 and V104. Negative feedback is used to minimize distortion and to provide a uniform output. The output is constant within 2 db over the frequency range covered by the instrument.

b. Voltage Amplifier. V103 is a type 6SJ7 tube connected in a standard voltage amplifier circuit. The oscillator output is applied through blocking capacitor C108 and the voltage divider consisting of R126 and R125 to the grid of V103. Resistor R127 is the cathode resistor. Screen voltage is applied to V103 from B+ through voltage dividers R128 and R129. The amplified signal is developed across plate load resistor R130 and is coupled to the following power amplifying stage by capacitor C109. The cathode resistor is not bypassed and is tied through C111 to the output of the power amplifier to provide the negative feedback necessary for minimizing distortion over the wide range of the equipment.

c. Power Amplifier. The output of voltage amplifying stage V103 is coupled to the beam power pentode V104 through C109. The signal is developed across grid resistor R131. Cathode resistor R132 is bypassed by C110 which is so small as to be effective only at higher frequencies. The output signal is developed across the plate load resistor consisting of R133, R134, and R135 in parallel. The signal is coupled to the output meter circuit and the output attenuator through C112.

37. Output System
(fig. 24)

The output system consists of an output level meter, M101, a gain control, R138, and a six-section, ladder-type attenuator consisting of resistors R152 through R157. The output meter operates from a full-wave, rectifier-type bridge circuit in which germanium crystals CR101 and CR102 are used as rectifying elements and resistors R160 and R161 complete the bridge. Gain control R138 is inserted in the circuit immediately preceding the output meter to set the voltage level at the input to the ladder attenuator. Resistor R137 is used for calibrating the meter, and R139 limits the current through the circuit. Capacitor C107 compensates for meter inaccuracies at higher frequencies. The ladder attenuator is calibrated on the basis of the instrument working into its rated load of 1,000 ohms.

38. Frequency Meter Circuit
(fig. 12)

a. A vibrating reed-type meter, M102, permits the accurate check of the output frequency of the oscillator at 60 cps and 400 cps. The reeds are so designed that one vibrates with maximum amplitude at an accurate 60 cps and the other at 400 cps. The meter has been factory-adjusted to an accuracy of ¾ of 1 percent. This meter is isolated from second oscillator stage tube V102 by cathode follower stage V108 to prevent frequency shifts when the meter is in operation.

b. Cathode follower V108 is coupled directly to the plate of V102, amplifier inverter stage of the oscillator section, through the voltage divider consisting of R151 and R149. The plate of V108 is connected to B+ supply. The cathode follower output is taken from the cathode resistor, R150, and is coupled to the frequency meter through capacitor C116. The meter is switched in and out of the circuit by switch S6.

39. Power Supply
(fig. 24)

a. Audio Oscillator TS–382A/U requires a 115-volt, single-phase, 50- to 1,600-cycle a-c power source. A-c power, which is applied to the primary winding of transformer T101, is fused by F101 and controlled by the OSC. ON-OFF switch, S2. When switch S2 is in the ON position, power is supplied to the four secondary windings of the transformer. One winding supplies 6.3 volts to the tube filaments and to pilot light I102. A second winding supplies 5 volts for the filament of rectifier tube V105. A third winding supplies 6.3 volts to the filament of voltage regulator tube V106. The remaining

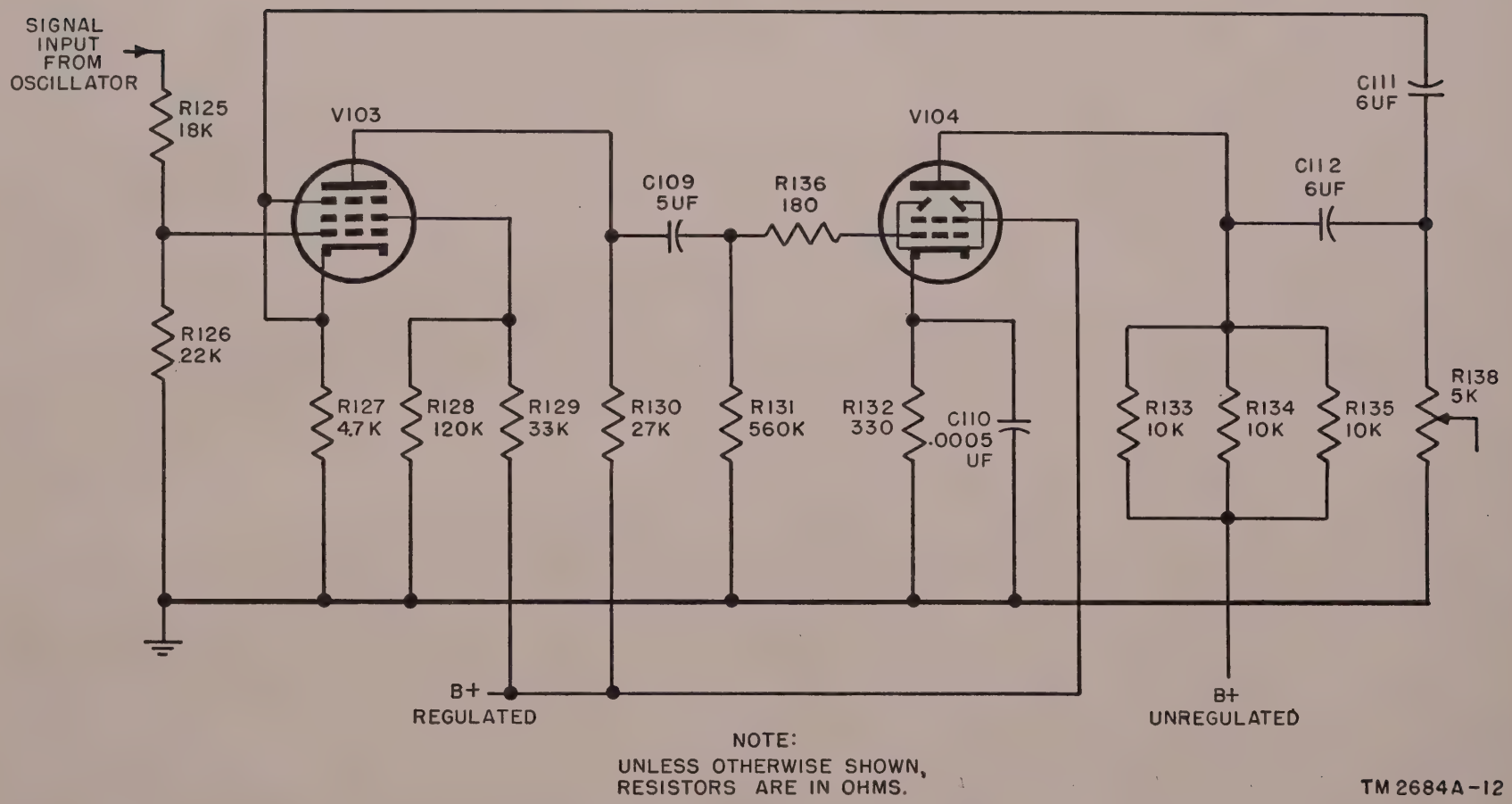


Figure 11. Audio amplifier, simplified schematic.

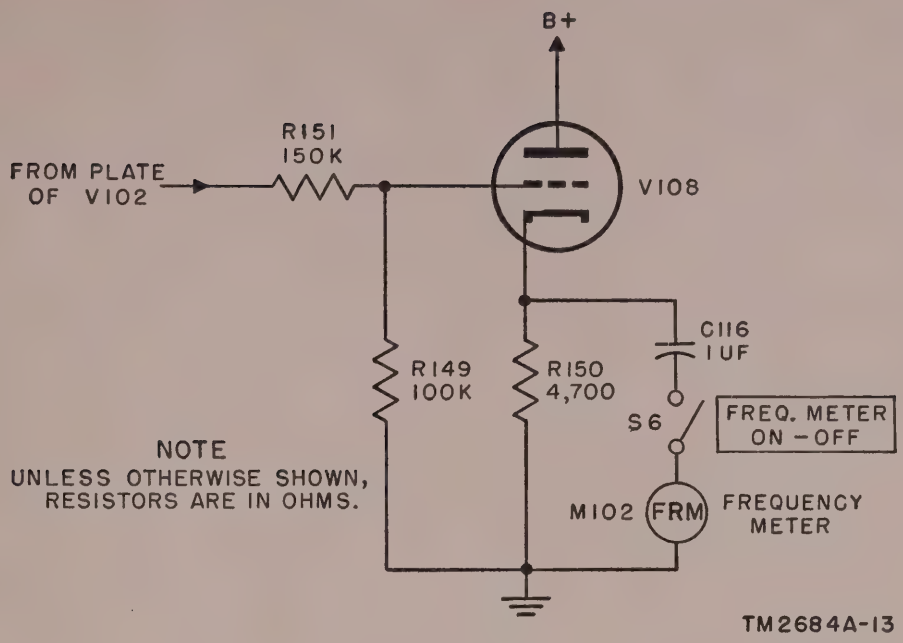


Figure 12. FREQ. METER circuit, simplified schematic.

secondary winding supplies 470 volts a-c on each side of the grounded center tap for the rectifier tube.

b. Rectifier V105 is a type 5Y3GT tube operating as a full-wave rectifier, supplying 420 volts d-c (direct current). The rectifier output voltage is filtered through the pi filter network consisting of C113, L101, and C114.

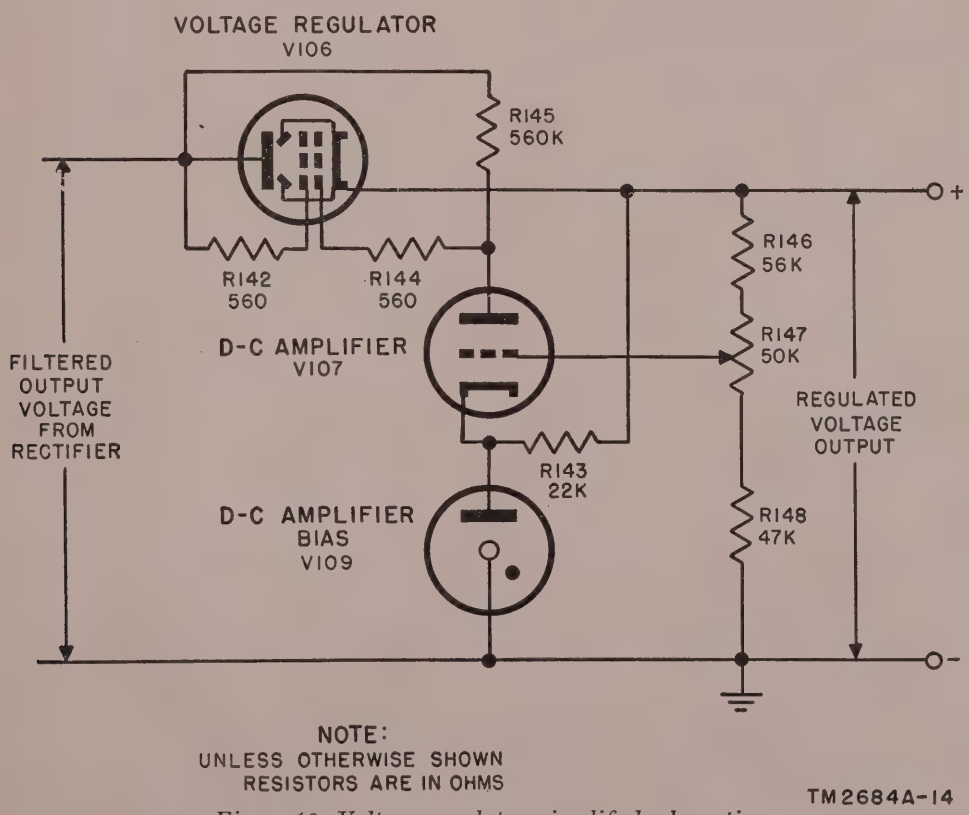


Figure 13. Voltage regulator, simplified schematic.

40. Voltage Regulator
(fig. 13)

a. The voltage regulator circuit supplies a B+ voltage that is constant despite load or line voltage fluctuations. The circuit consists of three stages: variable resistance tube V106, d-c amplifier V107, and voltage regulator tube V109. V109 clamps the cathode of V107 at a constant positive potential. V107 supplies a controlling voltage to the control grid of V106. V106 is in series with the B+ line, therefore the magnitude of the regulated B+ voltage will depend on the effective impedance of V106. This impedance is varied by V107 to oppose changes in the regulated B+ output.

b. An increase in the regulated B+ level will increase the voltage level at the arm of potentiometer R147, one of three bleeder resistors R146, R147, and R148 across the 230-volt regulated line. The increase on the arm of R147 will increase the current through V107, since the cathode of V107 is held at an unchanging potential by V109. Increasing the current through V107 will increase the voltage drop across plate load resistor R145, thus decreasing the grid volts on V106. The effective impedance of V106 is increased by its lowered grid voltage, hence the voltage drop across V106 is increased, diminishing the regulated B+ voltage to the desired level. Resistor R142 is inserted in the screen circuit of V106 as a parasitic suppressor, and R143 is a voltage dropping resistor in the anode circuit of V109.

41. Heaters
(fig. 24)

Heater Strips HR101 through HR104 are connected in parallel across the line when switches S3 and S4 are closed. S4 is a thermostatically controlled switch that maintains the oscillator at a desirable operating temperature. S4 consists of a contact mounted on a heat-sensitive bimetallic strip and a spring-loaded contact whose pressure against the first contact is set by the THERMOSTAT control. If the pressure is made large by turning the THERMOSTAT control clockwise, a great deal of heat will be required to deform the bimetallic strip so that the pressure is relieved to the point where the two contact points are open. When the contact is broken, the heaters are turned off until the bimetallic strip cools off and contact is made again. Pilot lamp I101 is connected across R140 in series with the heaters and indicates when they are operating.

CHAPTER 5

FIELD MAINTENANCE INSTRUCTIONS

Note. This chapter contains information for field maintenance. The amount of repair that can be performed by units having field maintenance responsibility is limited only by the tools and test equipment available, and by the skill of the repairman.

Section I. TROUBLE SHOOTING AT FIELD MAINTENANCE LEVEL

Warning: When servicing the audio oscillator, be extremely careful of the high voltages exposed. Discharge all filter capacitors before doing any testing. Before touching any part after the voltage is shut off, short the part to ground.

42. Trouble-Shooting Procedures

The first step in servicing a defective set is to sectionalize the fault. Sectionalization means tracing the fault to the *major component or circuit* responsible for the abnormal operation of the set. The second step is to localize the fault. Localization means tracing the fault to the defective *part* responsible for the abnormal condition. Some faults such as burned-out resistors, r-f arcing, and shorted transformers can often be located by sight, smell, and hearing. The majority of faults, however, must be localized by *checking voltage and resistance.* The tests listed below aid in isolating the source of trouble. To be effective the procedures should be followed in the order given. Remember that the servicing procedure should cause no further damage to the receiver. First, trouble should be localized to a single stage or circuit. Then the trouble may be isolated within that stage or circuit by appropriate voltage, resistance, and continuity measurements. The service procedure is summarized as follows:

a. Visual Inspection. The purpose of visual inspection (par. 31) is to locate any visible trouble. Through this inspection alone, the repairman may frequently discover the trouble, or determine the stage in which the trouble exists. This inspection is valuable in avoiding additional damage to the receiver which might occur through improper servicing methods and in forestalling future failures.

b. Input Resistance Measurements. These measurements prevent further damage to the receiver from possible short circuits. Since this test gives an indication of the condition of the filter circuits, its function is more than preventive.

c. Trouble-Shooting Chart. The trouble symptoms listed in this chart (par. 47) will aid greatly in localizing trouble.

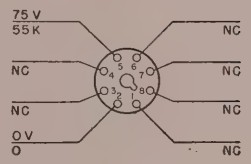
d. Intermittents. In all these tests the possibility of intermittents should not be overlooked. If present, this type of trouble often may be made to appear by tapping or jarring the set during testing.

43. Trouble-Shooting Data

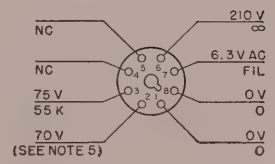
Take advantage of the material supplied in this manual. It will help in the rapid location of faults. Consult the following trouble-shooting data.

Fig. or par. No.	Description
Fig. 6	Block diagram.
Fig. 14	Voltage and resistance measurements chart.
Fig. 15	Location of parts, top view.
Figs. 16 and 17	Location of parts, bottom view.
Fig. 18	Location of parts on terminal boards.
Fig. 24	Audio Oscillator TS–382A/U, complete schematic.

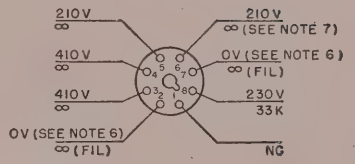
DC AMPLIFIER BIAS
V109
0A3



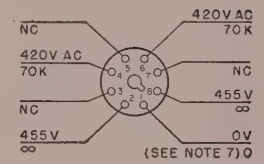
DC AMPLIFIER
V107
6SQ7



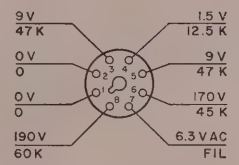
VOLTAGE REGULATOR
V106
6Y6-G



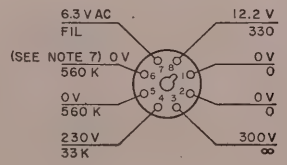
RECTIFIER
V105
5Y3-GT/G



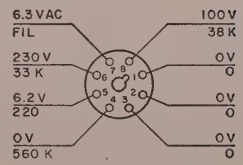
VOLTAGE AMPLIFIER
V103
6SJ7



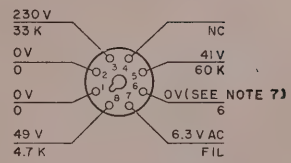
POWER AMPLIFIER
V104
6V6



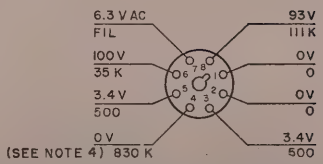
AMPLIFIER INVERTER
V102
6AG7



CATHODE FOLLOWER
V108
6J5



OSCILLATOR
V101
6SJ7



NOTES:

1. VOLTAGES AND RESISTANCES MEASURED TO GROUND WITH A 20,000 OHM-PER-VOLT METER.
2. THE VOLTAGES LISTED ABOVE ARE BASED ON THE FOLLOWING CONTROL SETTINGS:
   - RANGE SWITCH - - - - XIO
   - HEATER SWITCH - - - - OFF
   - OSC SWITCH - - - - - ON
   - MAIN TUNING DIAL - - 40
   - OUTPUT - - - - - - - - 10 V
   - INPUT - - - - - - - - - 115 V
3. NC INDICATES NO CONNECTION
4. 830K WITH S1 IN X10 POSITION
5. APPROX 40 K WITH R147 CENTERED.
6. 6.3 V AC MEASURED ACROSS FILAMENTS AND PIN 7.
7. CIRCUIT TIE POINT ONLY.

TM 2684A-25

Figure 14. Voltage and resistance measurements chart.

44. Test Equipment Required for Trouble Shooting

The test equipment required for trouble-shooting Audio Oscillator TS–382A/U is listed below. The technical manuals associated with the test equipment are also listed.

Test equipment	Technical manual
Tube Testers I–177 and I–177–A or equal.	TM 11–2627
Multimeter TS–352/U or equal	TM 11–5527
Oscilloscope BC–1060–A or equal	TM 11–2526
Sound Analyzer TS–615A/U	TM 11–5032
Electronic Multimeter TS–505/U	TM 11–5511
Frequency Calibrator Meter Set AN/URM–18.	

45. General Precautions

Whenever Audio Oscillator TS–382A/U is serviced, carefully observe the following precautions:

a. Be careful when the case is removed; dangerous voltages are exposed.

b. Careless replacement of parts often makes new faults inevitable. Note the following points:

(1) Before a part is unsoldered, note the position of the leads. If the part, such as a transformer, has numerous leads, tag each lead before removing it.

(2) Be careful not to damage other leads or parts by pushing or pulling them out of the way.

(3) Do not allow drops of solder to fall into the unit.

(4) A carelessly soldered connection may create a new fault. It is important to make well-soldered joints since a poorly soldered joint is one of the most difficult faults to find.

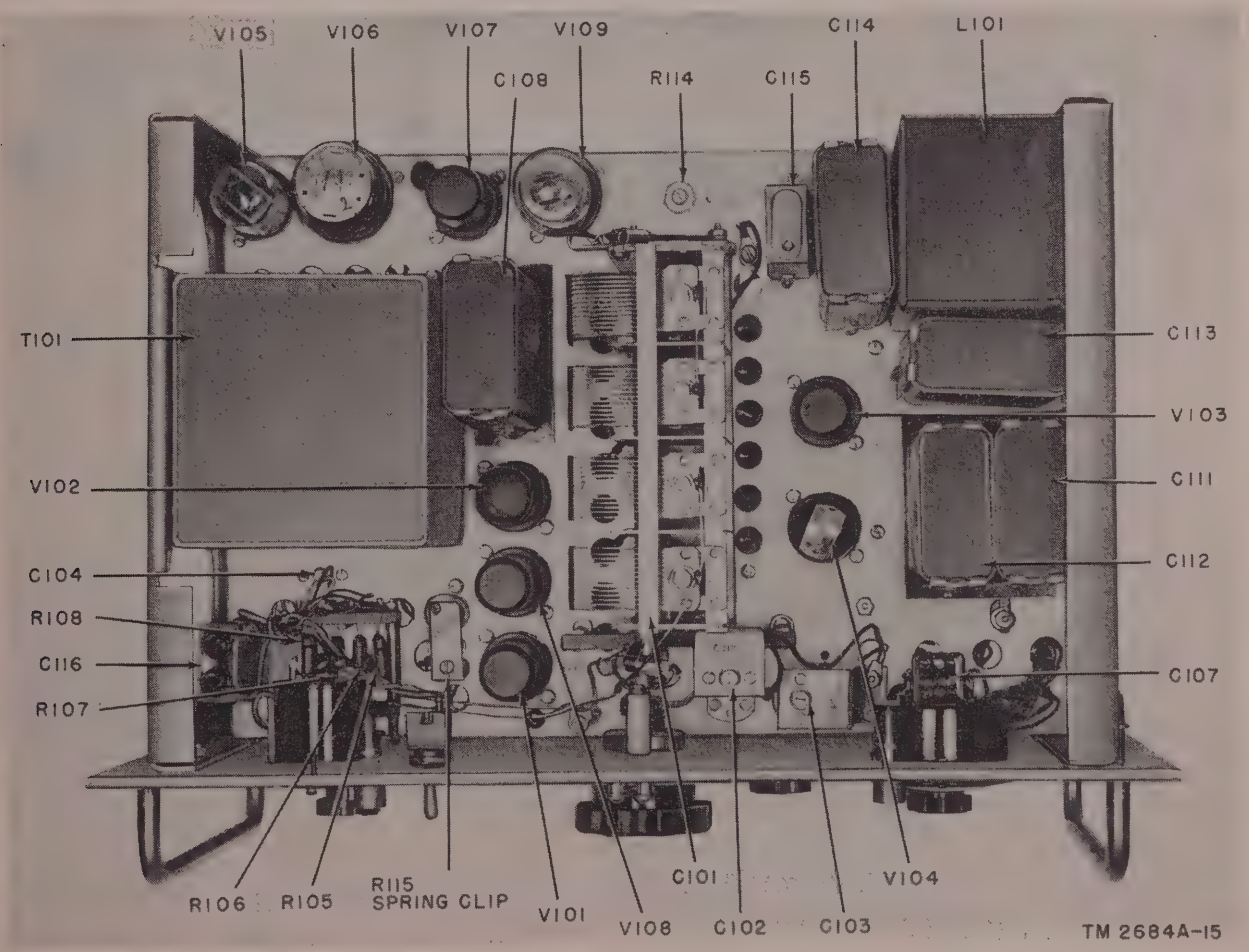


Figure 15. Location of parts, top view.

46. Checking Filament and B+ Circuits for Shorts

Trouble within the oscillator often may be detected by checking the resistance of the filament and h-v (high-voltage) circuits before applying power to the equipment, thereby avoiding damage to the power supply. Make the following checks before trying to put the oscillator in operation.

a. The resistance at the plate of V106 should be infinite, indicating that the unregulated h-v supply is not shorted to ground. The resistance from terminal 6 or 7 of power transformer T101 should be infinite, indicating that the filament circuit of V106 is not grounded.

b. The resistance to ground from the cathode (pin 8) of V106, the regulated 230-volt output of the power supply, should be approximately 33,000 ohms. A reading higher than normal indicates an open in a screen-dropping resistor or in the regulated 230-volt supply bleeder systems R146, R147, and R148. If the reading indicates a short, check C115 and the 230-volt supply wiring for a short. A reading lower than normal indicates a shorted coupling capacitor, a shorted bypass capacitor in a screen or plate circuit, or a short in a plate or screen grid circuit.

47. Trouble-Shooting Chart

The following chart is supplied as an aid in locating trouble in Audio Oscillator TS–382A/U. This chart lists the symptoms which the repairman observes while making a few simple tests, the probable cause for the faulty operation, and possible remedies for the fault. Normal resistance and voltage measurements are given in figure 14.

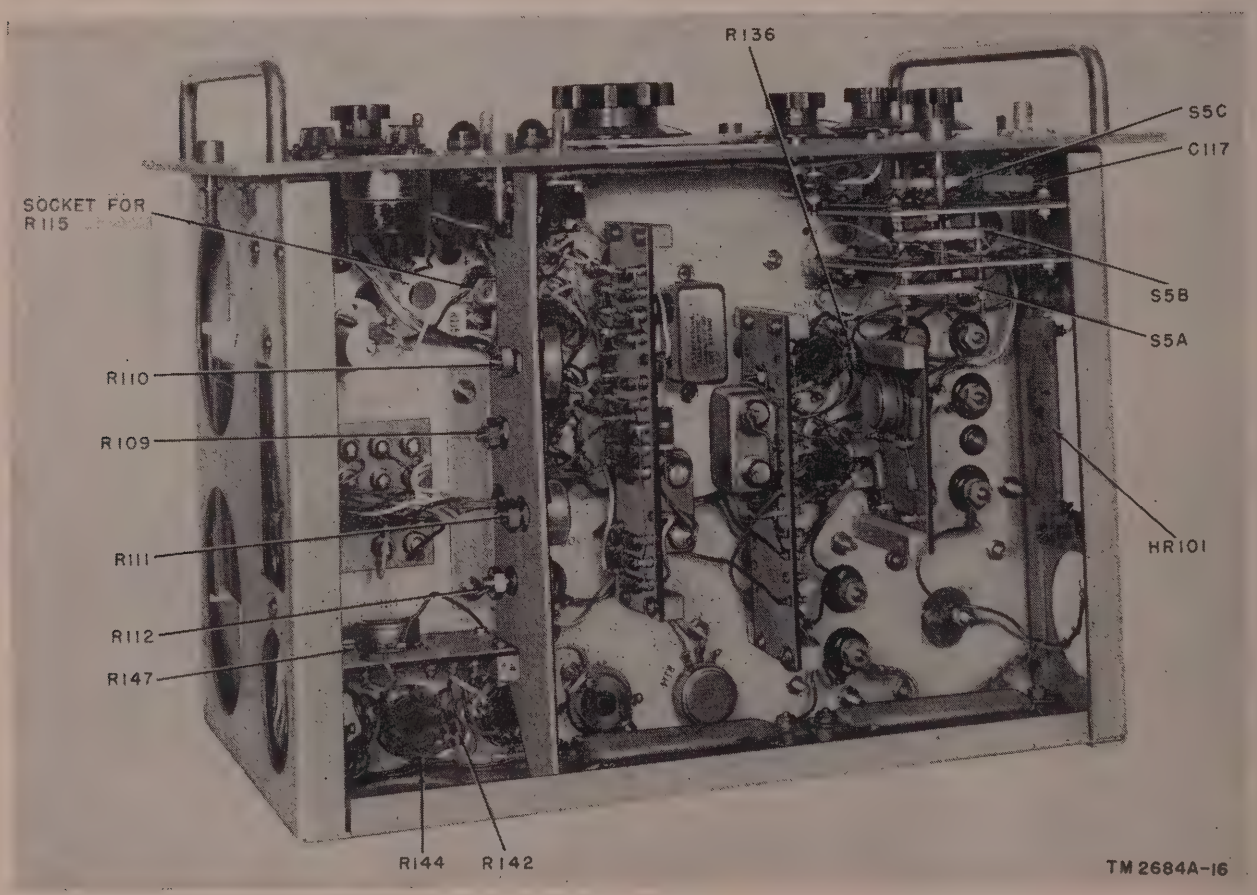


Figure 16. Location of parts, bottom view 1.

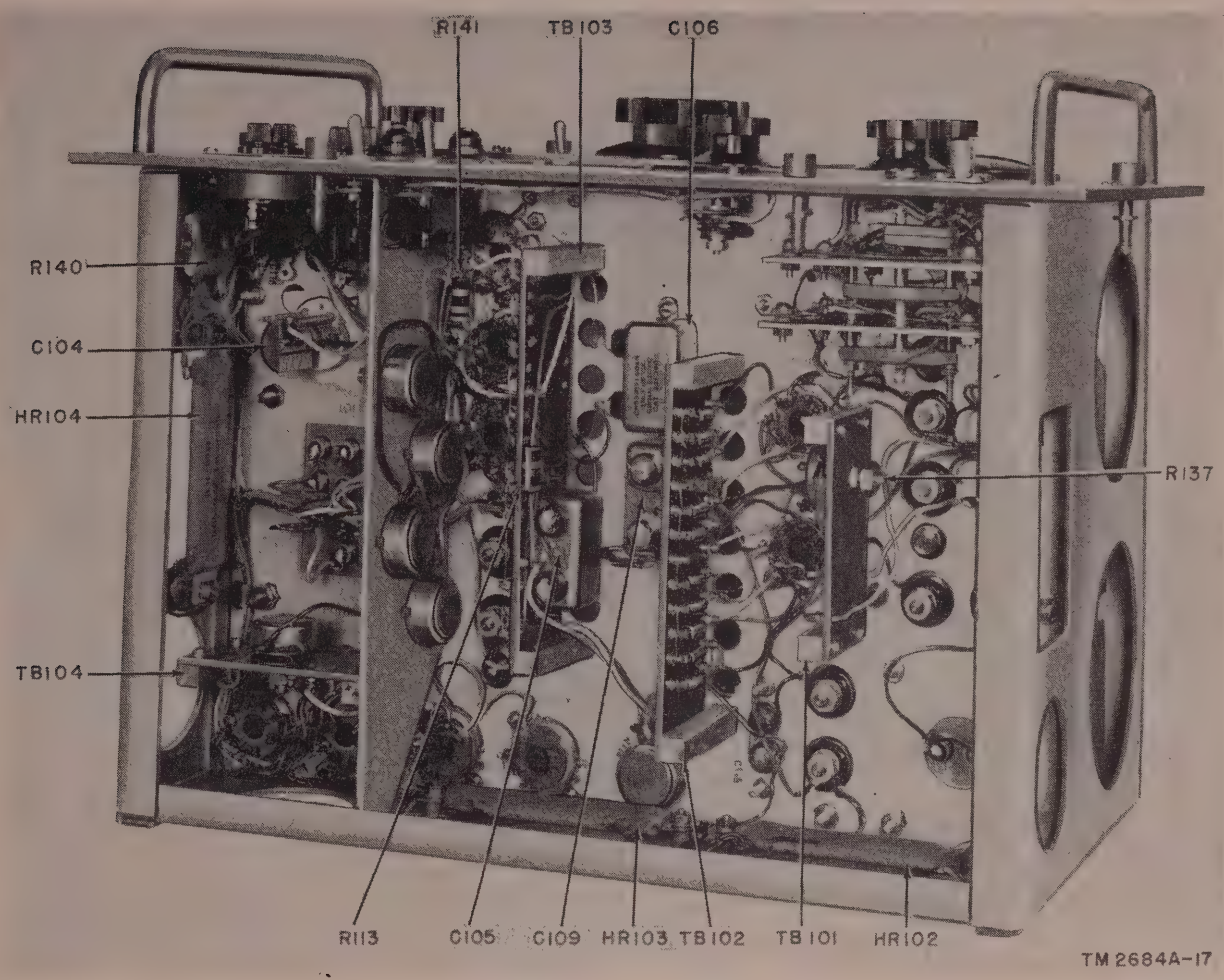


Figure 17. Location of parts, bottom view 2.

Symptom	Probable trouble	Correction
OSC. pilot light and HEATER pilot light do not glow when OSC. ON-OFF and HEATER ON-OFF switches are in ON position (THERMOSTAT control fully clockwise).	Power cable not properly connected or defective.	Check for line voltage across J101. Replace cable if defective.
	Defective fuses	Replace F101 or F102 if defective.
	Defective pilot lamps	Replace lamp I101 or I102.
Line voltage present at terminals of J101 but OSC. pilot still does not light.	Defective power transformer	Check power transformer T101 and its wiring. Replace if defective.
Tube filaments light but no output is indicated on OUTPUT LEVEL meter with OUTPUT LEVEL control turned fully clockwise.	R114 not properly adjusted	Adjust R114 for 23 volts a-c to ground from junction of C108 and R125.
	Defective tube or associated component.	Check tubes and replace if defective. Check d-c voltages of tubes in sequence: V105, V106, V107, V109, V101, V102, V103, V104, and V108. Compare the measured voltages against those listed in figure 14. Incorrect voltages indicate that an associated component is defective and should be replaced.
	Defective transformer	Check h-v winding on T101; if defective replace T101.

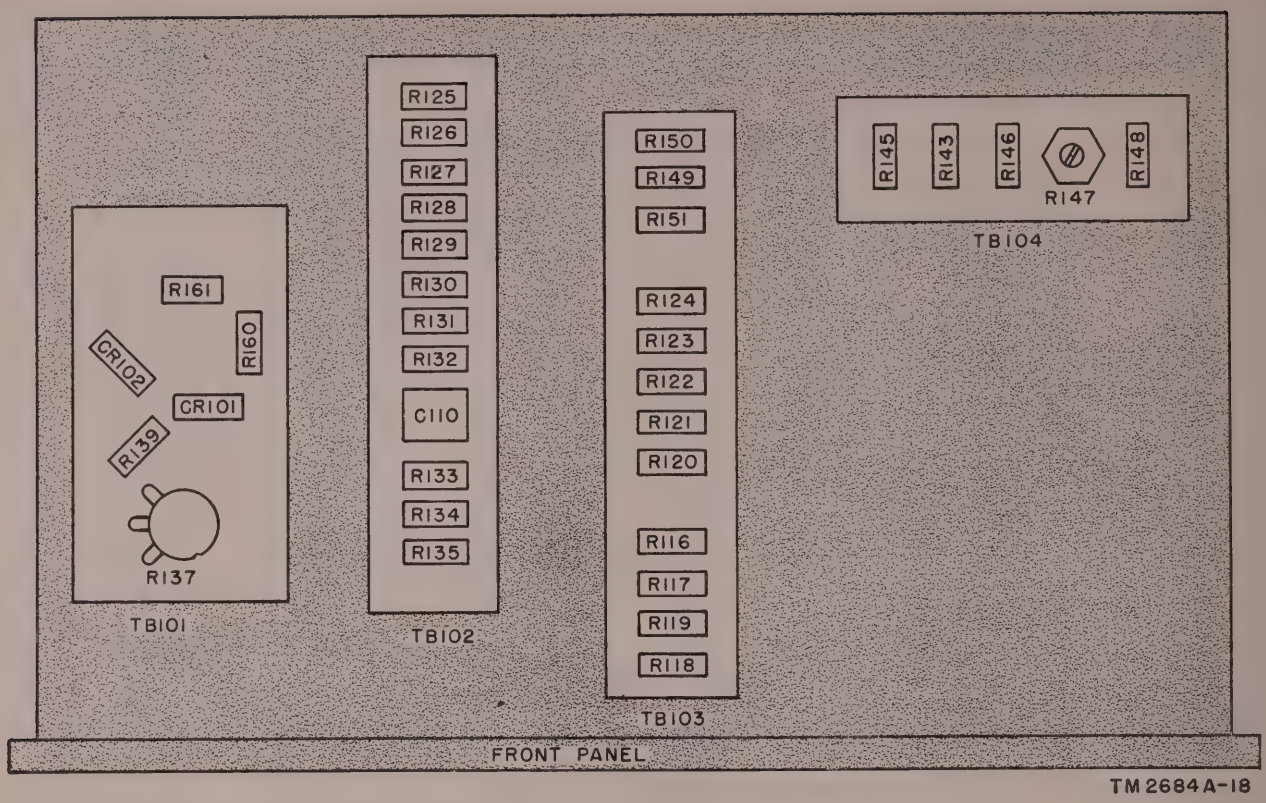


Figure 18. Location of parts on terminal boards.

Symptom	Probable trouble	Correction
OUTPUT LEVEL meter does not indicate output yet 23 volts a-c is present at junction of C108 and R125.	Defective crystal rectifiers in meter circuit.	If there is an a-c voltage at junction of C112 and C111 and meter shows no output, replace rectifiers CR101 and CR102.
	Defective meter	Check meter by disconnecting the leads and connecting a 1½-volt battery in series with a 2,000-ohm resistor. Meter is defective and should be replaced if needle does not swing past midscale.
Attenuator does not deliver proper submultiple of voltage indicated on meter at all attenuator settings.	Defective resistor on attenuator	When error exists between an externally connected a-c voltmeter (*with dummy load connected*) and the OUTPUT LEVEL meter on the ATTENUATOR 1 setting, check R152; .1 check R153, .01 check R154, .001 check R155, .0001 check R156, .00001 check R157.
Oscillator inoperative on X1 range but oscillates on all other ranges.	Defective R101, R108, or R112	Check resistors; replace if faulty.
Oscillator inoperative on X10 range	Defective R102, R107, or R111	Check resistors; replace if faulty.
Oscillator inoperative on X100 range	Defective R103, R106, or R110	Check resistors; replace if faulty.
Oscillator inoperative on X1000 range	Defective R104, R105, R109, or C104.	Check resistors; replace if faulty.
Oscillator does not oscillate over one portion of the main dial on all ranges.	C101 shorted	Check C101 for a short over its entire travel.

Symptom	Probable trouble	Correction
Oscillator does not oscillate over entire range.	Shorted C102, C103, or C104_____	Check capacitors for shorts.
FREQ. METER does not operate_____	Improper plate or grid voltage on V108.	Check R122, R123, R124, R151, R149, C108, and V108. Replace if defective.
	Defective C116, S6, or M102_____	Check C116, S6, or M102, replace if defective. The resistance of M102 should be approximately 6,000 ohms.
No output accompanied by improper voltage on plate (pin 8) of V101.	Defective R118 and/or R119; shorted C106 or C105; or defective V101.	Check listed items; replace if defective.
Reduced output accompanied by improper voltage on screen (pin 6) of V101.	Defective R116 or R117_____	Replace R116 or R117 if faulty.
Reduced output accompanied by improper voltage on plate (pin 8) of V102 or grid (pin 5) of V108.	Defective R122, R123, R124, R151, R149, or R150; shorted C108; defective V102 or V108.	Check listed items; replace if defective.
Reduced output accompanied by improper voltage on plate (pin 8) of V103.	Defective R130, shorted C109, or defective V103.	Check listed items; replace if faulty.
Reduced output with improper voltage on screen (pin 6) of V103.	Defective R128, R129, or faulty V103.	Check listed items; replace if faulty.
Reduced output with improper voltage on plate (pin 3) of V104.	Faulty R133, R134, R135, shorted C112, or defective V104.	Check listed items; replace if faulty.
Low output accompanied by improper voltage on plate (pin 3) of V106 and high hum level.	Faulty C113, C114, or shorted L101 (240 ohms).	Check listed items; replace if defective.
Low output voltage accompanied by improper voltage on plate (pin 6) of V107.	R145, R144, R143, or V106, V107, V109 may be faulty.	Check listed items; replace if defective.
Reduced output with improper voltage on filament (pin 5) of V105.	Defective C113, C114, V105, short L101 (240 ohms).	Check listed items; replace if necessary.

Section II. REPAIRS

48. Replacement of Parts

Most of the parts of Audio Oscillator TS–382A/U are readily accessible and are easily replaced if found to be faulty. Whenever a part is to be replaced that requires the disconnection of many leads, such as transformer T101 or ATTENUATOR switch S5, mark the leads with tags or other devices to avoid misconnection when the new part is installed.

Caution: Replacement of lamp R115 usually will require recalibration of the equipment. Do not change it without cause.

49. Refinishing

Instructions for the refinishing of badly marred panels on exterior cabinets are given in TM 9–2851.

Section III. CALIBRATION

50. General

a. When properly calibrated, Audio Oscillator TS–382A/U will produce an output signal of a frequency within 6 percent of the frequency indicated by the main tuning dial and the RANGE switch. The OUTPUT LEVEL meter reading multiplied by the ATTENUATOR setting will indicate a voltage output within 3 per-

cent of the actual output voltage. Recalibration of this instrument will not be required often. Prior to attempting recalibration of the oscillator, it must be ascertained by thorough checks (pars. 15*i*, 47, and 52) that recalibration is necessary.

b. The oscillator may be out of calibration for the following reasons:

(1) A component in the equipment is defective. In this case, replace the component only and do not attempt recalibration unless it is absolutely necessary.

(2) Small changes in the resistance or capacitance of the frequency-determining elements in the bridge circuit have occurred.

Caution: The oscillator must be allowed to warm up for *at least 20 minutes* prior to making any frequency checks or calibration adjustments.

51. Test Equipment Required for Calibration

The following test equipment or its equal is required for checking and adjusting the frequency calibration of Audio Oscillator TS–382A/U. An audio oscillator or frequency standard covering the range of Audio Oscillator TS–382A/U with an accuracy known to be better than 1 percent also is required.

Test equipment	Technical manual
Electronic Multimeter TS–505/U	TM 11–5511
Oscilloscope BC–1060–A	TM 11–2526

52. Frequency Calibration Check

To check the accuracy of the frequency calibration of Audio Oscillator TS–382A/U, connect the output of the oscillator to the vertical input (Y-axis) of the oscilloscope and the output of the test oscillator, or frequency standard, to the horizontal input (X-axis), as shown in figure 19. By observing the Lissajous figures on the oscilloscope, the frequency calibration of the oscillator can be checked. Checks must be made at the high and low ends of each of the oscillator ranges. Allow a 20-minute warm-up period, then proceed as follows:

a. Check the calibration of the low end of the X1 range by setting the frequency of the test oscillator to 20 cps and rocking the main tuning dial of the oscillator around 20 until a straight line, circle, or ellipse is observed on the oscilloscope. Note the audio oscillator dial setting.

b. Repeat the above procedure at the high end of the X1 range and at the high and low ends of the other ranges, using frequency settings appropriate to the range and dial end being checked.

c. No recalibration is necessary if the settings of the main tuning dial of the oscillator

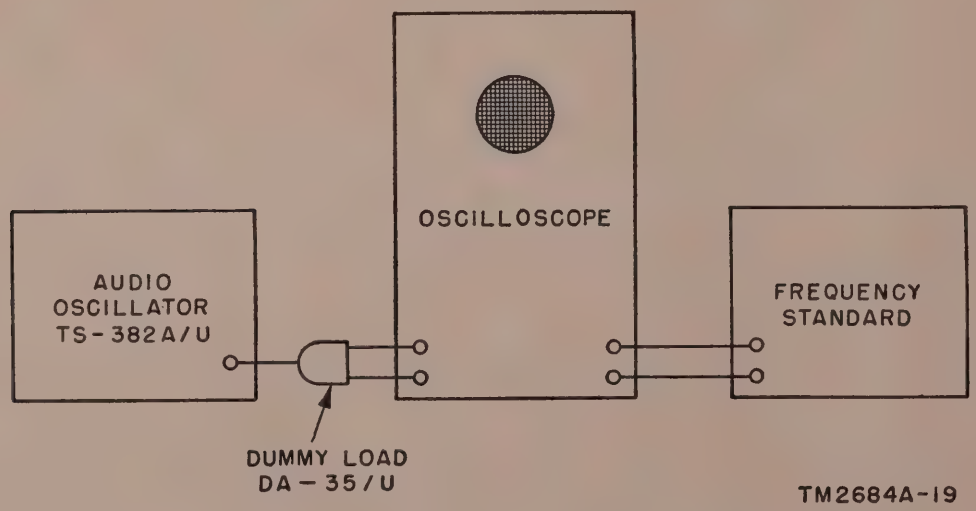


Figure 19. Equipment arranged for calibration.

are accurate to within 6 percent of the true frequencies against which the oscillator is being checked. For example, 6 percent of 180 cps is 10.8 cps ($.06 \times 180 = 10.8$). Therefore, the main tuning dial setting may be within 169.2 to 190.8 cps when the straight line, circle, or ellipse is observed, and still be within the accuracy of the instrument.

d. In the event the main tuning dial calibration is off by a constant percentage throughout all of the ranges, reset the dial (par. 53) rather than recalibrate the instrument.

53. Dial Calibration

(fig. 21)

a. In the event the tests outlined in the preceding paragraph indicate that the calibration is off throughout the entire range by a constant percentage, recalibrate the dial. After a 20-minute warm-up period, follow the procedure outlined below:

(1) Arrange the oscillator and the test oscillator as outlined in paragraph 52 and as shown in figure 19.

(2) Set the oscillator output to a known frequency, in comparison with the test oscillator output.

(3) Loosen the two set screws in the main tuning dial knob.

(4) Remove the knob.

(5) Loosen the three set screws on the scale ring securing the dial scale to the shaft.

(6) Holding the shaft firmly, twist the dial to indicate the known frequency to which the oscillator is set.

(7) Retighten the three set screws on the scale ring.

(8) Replace the main tuning dial knob.

b. At the same time as dial recalibration is accomplished, check to see that the rotor of main tuning capacitor C101 does not hit its frame at either end of its travel. When the tuning knob is turned to the limit of its travel (limited by the mechanical stop (fig. 20)), the rotor of C101 must not touch the frame. If necessary, the travel of the C101 rotor may be adjusted in the following manner.

(1) Run the tuning control to the point where the capacitor rotor touches the capacitor frame.

(2) Loosen the two set screws in the dial shaft collar (fig. 20).

(3) Turn the tuning control until the capacitor rotor just clears the capacitor frame.

(4) Turn the dial shaft collar until the mechanical stop is engaged.

(5) Retighten the two set screws in the dial shaft collar.

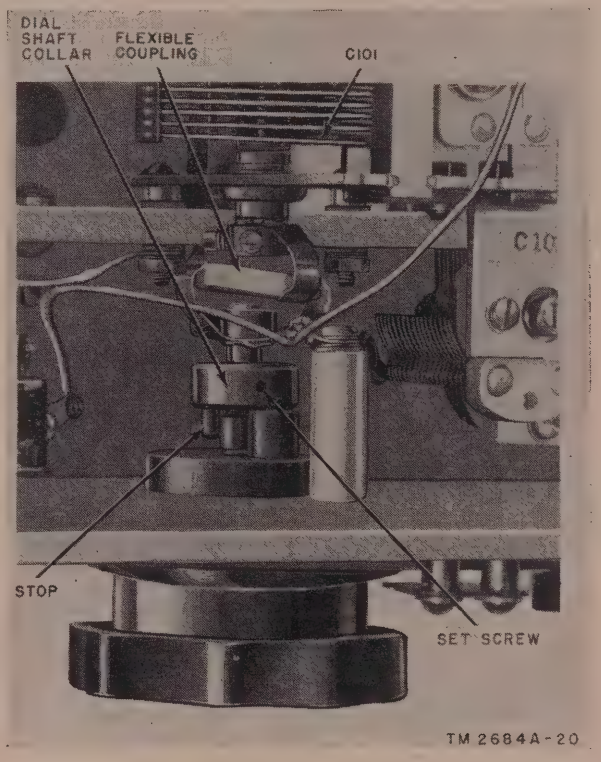


Figure 20. Location of set screw in dial shaft collar.

54. Oscillator Calibration

a. Preliminary Steps. Set up the oscillator, test oscillator, and oscilloscope as shown in figure 19, with addition of a vtvm (vacuum-tube voltmeter) across the output side of the dummy load. Follow the procedure outlined below.

(1) Loosen the locknuts on potentiometers R109 through R112, R147, R114, R137, and C104 (figs. 15, 16, 17, and 18).

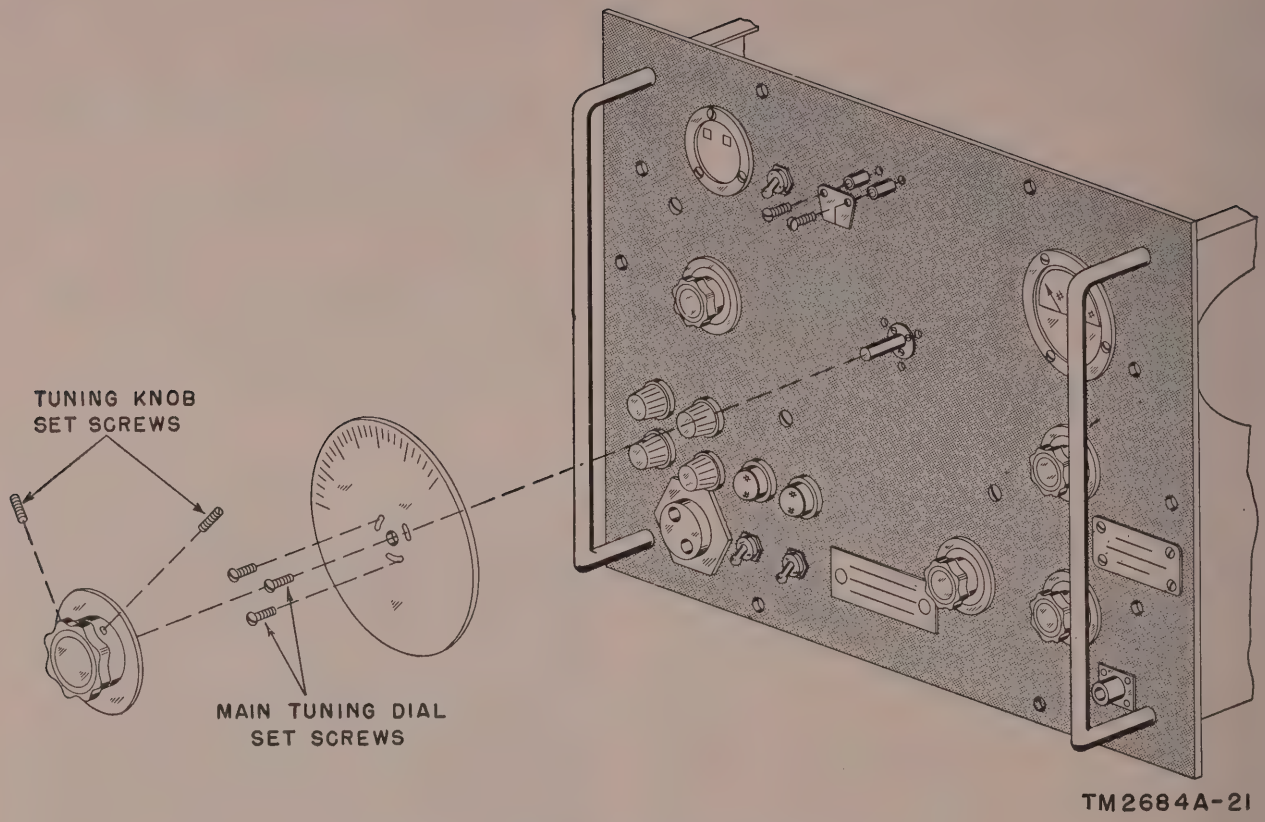


Figure 21. Location of main tuning dial set screws.

(2) Set frequency-determining resistors R109 through R112 to a point midway between their extreme of rotational travel.

(3) Set frequency-determining capacitors C102, C103, and C104 so that their plates are half meshed (one-half of their maximum capacitance).

(4) Adjust R147 so that the voltage between pin 4 of V104 and ground is 230 volts d-c.

(5) Adjust R114 (fig. 15) so that the voltage between the junction of C108 and R125 and ground is 23 volts a-c. Make this measurement with a vtvm.

(6) Turn the ATTENUATOR switch to the 10 position, turn the RANGE switch to the X100 position, and turn the OUTPUT LEVEL control fully clockwise.

(7) Turn the main tuning dial to the l-f (low-frequency) end, and observe the output voltage on the vtvm. It should be approximately 11 to 11.5 volts. Now turn the dial to the h-f (high-frequency) end, and adjust C102 (using a nonmetallic alinement tool) so that the voltage at the high end equals the voltage at the low end of the dial.

b. Calibration. Once the preceding instructions have been followed, the oscillator can be calibrated. Follow the sequence of calibration as outlined below. The process of calibration consists of setting the output frequency of the test oscillator to that frequency to which it is desired to adjust the oscillator, and adjusting the oscillator until a straight line, circle, or ellipse appear on the oscilloscope. The straight line, ellipse, etc., indicate that the output frequency of the audio oscillator matches exactly the output frequency of the test oscillator. Follow the procedure below.

(1) Start the calibration in the X100 range. Set the output of the test oscillator to 2,000 cps, and set the oscillator main tuning dial to 20, with the

RANGE switch in the X100 position. Adjust R110 for a straight line on the scope. Now check the calibration at 20,000 cps. Adjust C102 and C103 so that tracking is proper at the high end of the dial. Since C102, C103, and R110 are mutually interdependent, repeat the above adjustments until tracking is correct at both the low and high ends of the X100 range. Be careful when adjusting C102 and C103, because the constancy of the oscillator output voltage while rotating main tuning capacitor C101 is determined by the settings of these two capacitors.

(2) Set the RANGE switch to the X1 position and set the oscillator main tuning control to 20. Tune the output of the test oscillator to 20 cps. Adjust R112 until a straight line, etc., is observed on the oscilloscope. Calibration of the high end of the X1 range also will be correct if the settings of C102 and C103 were made properly in step 1.

(3) The X10 range calibration is accomplished as was the X1 range, with appropriate settings of oscillator and test oscillator frequency controls and adjustment of R111:

(4) To calibrate the X1000 range, set the oscillator main tuning dial to 20, set the test oscillator frequency to 20,000 cps, and set the RANGE switch to the X1000 position. Adjust R109 for a straight line, circle, or ellipse on the oscilloscope. Change the tuning controls of both oscillators to 200,000 cps. Adjust C104 for a straight line, circle, or ellipse on the oscilloscope. There should be no difficulty in setting the high end of the X1000 range, since C104 is effective only in this range.

(5) Tighten the locknuts on R109, R110, R111, R112, R114, R147, and C104.

55. Output Meter Calibration

Calibration of the OUTPUT LEVEL meter is accomplished easily by following the procedure below.

a. Connect Dummy Load DA–35/U to the oscillator output cord.

b. Connect Electronic Multimeter TS–505/U to the dummy load.

c. Set the ATTENUATOR switch to the X10 position.

d. Adjust the OUTPUT LEVEL control so that the multimeter reads 10 volts.

e. Adjust R137 until the OUTPUT LEVEL meter reads 10 volts.

Section IV. FINAL TESTING

56. Final Testing Audio Oscillator TS–382A/U

a. General. This section is intended as a guide in determining the quality of a repaired Audio Oscillator TS–382A/U. The tests indicated below may be made by test personnel having adequate test equipment and the necessary skills. Final testing of this equipment consists of checking the frequency calibration of the oscillator and making a distortion analysis of the output voltage waveform (par. 57).

b. Frequency Calibration Test. Repeat the test procedure outlined in paragraph 52 at the completion of any repairs or adjustments to the oscillator.

57. Distortion Analysis

a. Since it is possible for a tube to cause excessive distortion of the output wave without seemingly affecting the operation of the oscillator, measure the distortion whenever tubes V101 through V104 are replaced. If the measured distortion is greater than 3 percent, use another tube.

b. Sound Analyzer TS–615A/U is a harmonic wave analyzer which can be used to make an analysis of the harmonic content or distortion of the Audio Oscillator TS–382A/U output voltage. Sound Analyzer TS–615A/U is covered in TM 11–5032.

CHAPTER 6

SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

58. Repacking for Shipment or Limited Storage

The exact procedure in repacking for shipment or limited storage depends on the material available and the conditions under which the equipment is to be shipped or stored. Reverse the instructions given in paragraph 9 as a general guide to adequate packing.

59. Demolition of Matériel to Prevent Enemy Use

Follow the procedure given in *a* through *g* below to prevent the enemy from using or salvaging this equipment. Demolition of the equipment will be accomplished only upon order of the commander.

a. Smash. Smash the controls, tubes, switches, capacitors, and transformers, using sledges, axes, handaxes, pickaxes, hammers, or any heavy tool.

b. Cut. Cut cords and wiring, using axes, handaxes, or machetes.

c. Burn. Burn cords, resistors, capacitors, wiring, and technical manuals, using gasoline, kerosene, oil, flame throwers, or incendiary grenades.

d. Bend. Bend panels, cabinet, and chassis.

e. Explosives. If explosives are necessary, use firearms, grenades, or TNT.

f. Disposal. Bury or scatter the destroyed parts in slit trenches, fox holes, or other holes, or throw them into streams.

g. Destroy Everything.

APPENDIX I
REFERENCES

Note. For availability of items listed, check SR 310–20–3 and SR 310–20–4. Check Department of the Army Supply Catalog SIG 1 for Signal Corps supply catalogs.

1. Army Regulations

AR 380–5	Safeguarding Military Information.
AR 750–5	Maintenance of Supplies and Equipment (Maintenance Responsibilities and Shop Operation).

2. Supply Publications

SIG 1	Introduction and Index.
SIG 3	List of Items for Troop Issue.
SIG 5	Stock List of All Items.
SIG 6	Sets of Equipment.
SIG 7 & 8	Organizational Maintenance Allowances and Field and Depot Maintenance Stockage Guide.
SB 11–47	Preparation and Submission of Requisitions for Signal Corps Supplies.
SB 11–76	Signal Corps Kit and Materials for Moisture- and Fungi-Resistant Treatment.

3. Publications on Auxiliary Equipment and Test Equipment

TM 11–472	Repair and Calibration of Electrical Measuring Instruments.
TM 11–2526	Oscilloscope BC–1060–A.
TM 11–2627	Tube Testers I–177 and I–177–A.
TM 11–5032	Sound Analyzer TS–615A/U.
TM 11–5511	Electronic Multimeter TS–505/U.
TM 11–5527	Multimeter TS–352/U.

4. Painting, Preserving, and Lubrication

TB SIG 13	Moistureproofing and Fungiproofing Signal Corps Equipment.
TB SIG 69	Lubrication of Ground Signal Equipment.
TM 9–2851	Painting Instructions for Field Use.

5. Camouflage

FM 5–20	Camouflage, Basic Principles.

6. Decontamination

TM 3–220	Decontamination.

7. Demolition

FM 5–25	Explosives and Demolitions.

8. Other Publications

SR 310–20–3	Index of Training Publications (Field Manuals, Training Circulars, Firing Tables and Charts, Army Training Programs, Mobilization Training Programs, Army Training Tests, Graphic Training Aids, Joint Army-Navy Air Force Publications, Combined Communications Board Publications and Allied Communications Publications).

SR 310–20–4	Index of Technical Manuals, Technical Regulations, Technical Bulletins, Supply Bulletins, Lubrication Orders, Modification Work Orders, Tables of Organization and Equipment, Reduction Tables, Tables of Allowances, Tables of Organization, and Tables of Equipment.
SR 700–45–5	Unsatisfactory Equipment Report (Reports Control Symbol CSGLD–247).
SR 745–45–5 AFR 71–4	Report of Damaged or Improper Shipment (Reports Control Symbols CSGLD–66 (Army) and AF–MC–U2 (Air Force)).
TB SIG 25	Preventive Maintenance of Power Cords.
TB SIG 66	Winter Maintenance of Signal Equipment.
TB SIG 72	Tropical Maintenance of Ground Signal Equipment.
TB SIG 75	Desert Maintenance of Ground Signal Equipment.
TB SIG 123	Preventive Maintenance Practices for Ground Signal Equipment.
TB SIG 178	Preventive Maintenance Guide for Radio Communication Equipment.
TB SIG 219	Operation of Signal Equipment at Low Temperatures.
TM 11–453	Shop Work.
TM 11–455	Radio Fundamentals.
TM 11–466	Radar Electronic Fundamentals.
TM 11–476	Radio Direction Finding.
TM 11–483	Suppression of Radio Noises.
TM 11–486	Electrical Communication Systems Engineering.
TM 11–681	Electrical Fundamentals (Alternating Current).
TM 11–660	Introduction to Electronics.
TM 11–661	Electrical Fundamentals (Direct Current).
TM 11–4000	Trouble Shooting and Repair of Radio Equipment.

9. Abbreviations

a-c	alternating-current
cps	cycles per second
db	decibel
d-c	direct-current
h-f	high-frequency
h-v	high-voltage
l-f	low-frequency
mw	milliwatt
r-f	radio-frequency
$\mu\mu$f	micromicrofarad
vtvm	vacuum-tube voltmeter

APPENDIX II

IDENTIFICATION TABLE OF PARTS

1. Requisitioning Parts

The fact that a part is listed in this table is not sufficient basis for requisitioning the item. Requisitions must cite an authorized basis, such as a specific T/O&E, T/A, SIG 7 & 8, list of allowances of expendable material, or other authorized supply basis. The Department of the Army Supply Catalog applicable to the equipment covered in this manual is SIG 7 & 8 TS–382/U. For an index of available supply catalogs in the Signal portion of the Department of the Army Supply Catalog, see the latest issue of SIG 1.

2. Identification Table of Parts for Audio Oscillator TS–382A/U

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	AUDIO OSCILLATOR TS–382A/U: BFO controlled; 20 cyc to 200 kc in 4 ranges; 100 mw output; freq characteristic ±2.0 db; output impedance 1000 ohms; operates from 115 v, 50 to 1600 cpc; 12¾" lg x 18¾" wd x 10" h o/a.		3F4325–382A
	CONNECTOR, adapter: Adapter Connector UG–514/U, male 1 end, female other end, female in ctr; 1 rd female cont, 2 banana type plug type pins, female binding post-banana jack assem; angle type, angle 90 deg; adapts Radio Frequency Plug UG–88/U to pr of banana type pins and pr of binding post-banana jack assem.		2Z7390–514
C110	CAPACITOR, fixed: mica; 510 μμf ±5%; 500 vdcw; JAN type CM20B511J.	Cathode bypass for V104	3K2051122
C107	CAPACITOR, fixed: mica; 8200 μμf ±10%; 500 vdcw; JAN type CM40B822K.	Frequency-compensating capacitor for output meter circuit.	3K4088221
C105, C106, C109	CAPACITOR, fixed: paper; 500,000 μμf ±10%; 600 vdcw; JAN type CP53B1EF504K.	C105: Coupling capacitor, V101 to V102. C106: Plate decoupler, V101. C109: Coupling capacitor, V103 to V104.	3DA500–522
C115, C116	CAPACITOR, fixed: paper; 1 μf ±10%; 600 vdcw; JAN type CP61B1FF105K.	C115: A-f bypass for voltage regulator circuit. C116: Couples output of V108 to M102.	3DB1–192
C108, C111 through C114	CAPACITOR, fixed: paper; 6 μf ±10%; 600 vdcw; JAN type CP70E1FF605K.	C108: Coupling capacitor V102 to V103. C111: Couples negative feedback from V104 to V103. C112: D-c blocking capacitor. C113 and C114: Power supply filter capacitors.	3DB6–41
C103	CAPACITOR, variable: air; plate meshing type; 4 to 23 μμf; JAN type CT2B025.	Trimmer capacitor for C101B	3D9023V–12
C102	CAPACITOR, variable: air; plate meshing type; 7.5 to 99.0 μμf; JAN type CT2B100.	Trimmer capacitor for C101A	3D9099V–6

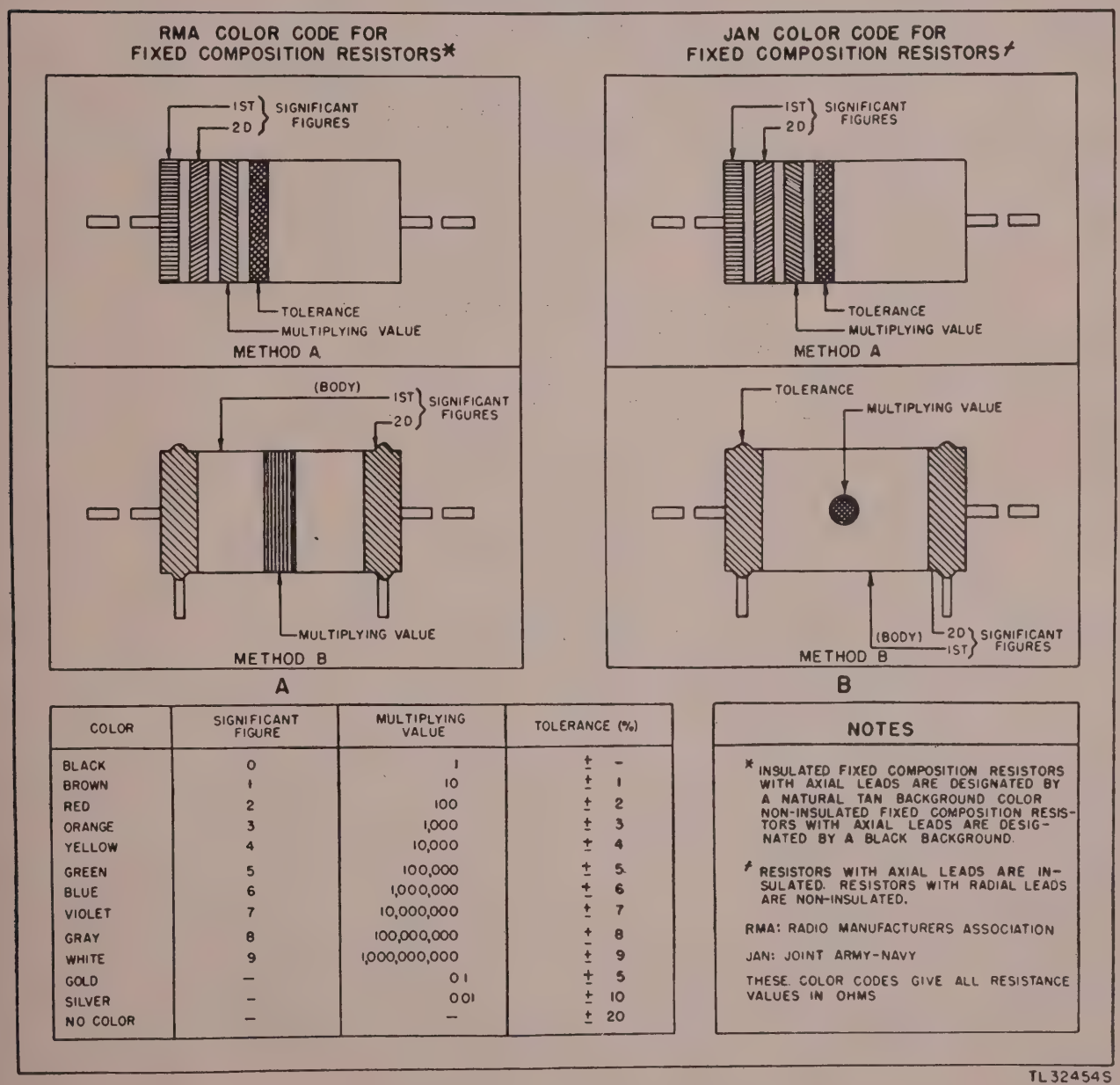
Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
C104	CAPACITOR, variable: air; plate meshing type; 9.0 to 143 $\mu\mu$f; JAN type CT1C150.	Cathode bypass capacitor for V101	3D9143V–1
C101	CAPACITOR, variable: air; plate meshing type; 4 sect; 8.6 to 522.6 $\mu\mu$f ea sect; 6" lg x 2" wd x 3½" d, excluding shaft; Oak part #S–4770–4–60.	Part of frequency-determining bridge for oscillator V101.	3D9522VE6
J102	CONNECTOR, receptacle: Receptacle UG–290/U; 1 rd female cont, straight.	OUTPUT jack	2Z7390–290
J101	CONNECTOR, receptacle: 2 parallel blade male cont; straight; 2¼" lg x 1¾" wd x 1¼" d o/a.	Power input jack	2Z3022–72
	COUPLING, flexible: $\frac{5}{32}$" thk ceramic base, 1" sq w/corners cut off.	Couples C101 to main tuning knob	2ZK3290–11
CR101, CR102	CRYSTAL UNIT, rectifying: for meter ckt; inverse voltage 50 v max; ⅜" lg x ⅛" dia.	Rectifiers for meter circuit	2JCK705
	DIAL: control; aluminum; 6⅛" dia x $\frac{3}{32}$" thk o/a.	Main tuning dial	2Z3723–319
	DUMMY LOAD DA–35/U		2Z3905–35
F101 through F104	FUSE FU–27: 2 amp	F101: Fuse in power transformer primary. F102: Fuse in heater supply line. F103 and F104: Spare fuses.	3Z1927
H101 through H104	HOLDER, fuse: extractor post type; for single 3AG cartridge fuse; 2⅛" lg x $\frac{33}{32}$" dia o/a.	H101: Holds and protects fuse F101. H102: Holds and protects fuse F102. H103: Holds and protects fuse F103. H104: Holds and protects fuse F104.	3Z3275
	KNOB: rd; black bakelite; for ¼" dia shaft; marked w/white line pointer; 1½" dia x 1" thk.	RANGE switch knob THERMOSTAT control knob. ATTENUATOR switch knob. OUTPUT LEVEL control knob.	2Z5822–614
	KNOB: rd, fluted; black bakelite; for ½" dia shaft; 3" dia x 1" h o/a.	Main tuning control	2Z5822–504
I101, I102	LAMP LM–52: 6–8 v, .15 amp; miniature bayonet base.	I101: Heater pilot lamp I102: Oscillator pilot lamp.	2Z5952
H103	LAMPHOLDER: candelabra; 1¼" lg x 1¼" wd x ¾" thk o/a.	Holder for R115	2Z5884–106
R115	LAMP, incandescent: 110 v, 3 w, 1 amp; candelabra screw base; 1⅞" o/a.	Cathode resistor for V101	2Z5879–11
M102	METER, frequency indicator: AC; 60 and 400 cps; rd, HS; metal flush mtg case; 2" dia fl x 1½" dia body x 1⅛" d behind fl.	Frequency meter	3F3310–2.2
M101	METER, voltmeter: AC; range 0 to 1.2 v; rd, HS steel flush mtg case; 2.675" dia fl x 2.150" dia body x 1.56" d behind fl.	Output level meter	3F8001–10
L101	REACTOR: filter choke; 20 hy, .08 amp; 240 ohms DC resistance; 1750 v RMS test; HS metal case; 4¼" x 3" sq.	Choke in power supply filter	3C574D–1
R140	RESISTOR, fixed: WW; 5 ohms ±5%; 15 w; JAN type RW20G5RO.	Shunt resistor for heater pilot lamp.	3RW10531
R141	RESISTOR, fixed: comp; 33 ohms ±10%; 2 w; JAN type RC20BF330K.	Current limiter in oscillator pilot circuit.	3RC20BF330K
R159, R136	RESISTOR, fixed: comp; 180 ohms ±10%; ½ w; JAN type RC20BF181K.	R159: Parasitic suppressor for V102. R136: Parasitic suppressor for V104.	3RC20BF181K
R121	RESISTOR, fixed: comp; 220 ohms ±10%; 1 w; JAN type RC30BF221K.	Cathode resistor for V102	3RC30BF221K

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
R132	RESISTOR, fixed: comp; 330 ohms ±10%; 1 w; JAN type RC30BF331K.	Cathode resistor for V104	3RC30BF331K
HR101 through HR104	RESISTOR, fixed: WW; 500 ohms ±5%; 37 w; JAN type RW22G501.	Oscillator heating elements	3RW22552
R142, R144	RESISTOR, fixed: comp; 560 ohms ±10%; ½ w; JAN type RC20BF561K.	R142: Parasitic suppressor R144: Grid resistor for V106.	3RC20BF561K
R160, R161	RESISTOR, fixed: comp; 1000 ohms ±1%; ½ w.	Part of output meter bridge circuit.	3Z6100–299
R152	RESISTOR, fixed: WW; 1023.6 ohms ±½%; ½ w; 1 tap, 123.6 ohms, ½ w.	Part of output attenuator circuit	3Z6102C3
R157	RESISTOR, fixed: WW; 1098.9 ohms ±½%; ½ w; 1 tap, 109.9 ohms, ½ w.	Part of output attenuator circuit	3Z6109H8
R153 through R156	RESISTOR, fixed: WW; 1111.1 ohms ±½%; ½ w; 1 tap, 122.1 ohms, ½ w.	Part of output attenuator circuit	3Z6111A1
R113	RESISTOR, fixed: comp; 3000 ohms ±5%; 2 w; JAN type RC42BF302J.	Part of voltage divider controlling negative feedback to V101.	3RC42BF302J
R139	RESISTOR, fixed: comp; 3900 ohms ±1%; ½ w.	CURRENT limiter in output meter circuit.	3Z6390–27
R127, R150	RESISTOR, fixed: comp; 4700 ohms ±10%; 1 w; JAN type RC30BF472K.	R127: Cathode bias resistor for V103. R150: Cathode resistor for V108.	3RC30BF472K
R105	RESISTOR, fixed: comp; 8100 ohms ±1%; ½ w.	Part of frequency-determining bridge circuit.	3Z6581–2
R104	RESISTOR, fixed: comp; 8300 ohms ±½%; ½ w.	Part of frequency-determining bridge circuit.	3Z6583–1
R133 through R135	RESISTOR, fixed: comp; 10,000 ohms ±10%; 2 w; JAN type RC42BF103K.	Paralleled as plate load for V104	3RC42BF103K
R122 through R124	RESISTOR, fixed: comp; 15,000 ohms ±10%; 2 w; JAN type RC42BF153K.	Paralleled as plate load for V102	3RC42BF153K
R125	RESISTOR, fixed: comp; 18,000 ohms ±10%; 1 w; JAN type RC30BF183K.	Voltage-dropping resistor in grid circuit of V103.	3RC30BF183K
R119, R126	RESISTOR, fixed: comp; 22,000 ohms ±10%; 1 w; JAN type RC30BF223K.	R119: Part of plate decoupling circuit for V101. R126: Grid resistor for V103.	3RC30BF223K
R143	RESISTOR, fixed: comp; 22,000 ohms ±10%; 2 w; JAN type RC42BF223K.	Voltage-dropping resistor	3RC42BF223K
R130	RESISTOR, fixed: comp; 27,000 ohms ±10%; 1 w; JAN type RC30BF273K.	Plate load for V103	3RC30BF273K
R129	RESISTOR, fixed: comp; 33,000 ohms ±10%; 1 w; JAN type RC30BF333K.	Screen-dropping resistor for V103	3RC30BF333K
R148	RESISTOR, fixed: comp; 47,000 ohms ±10%; 1 w; JAN type RC30BF473K.	Part of power supply bleeder	3RC30BF473K
R116 through R118, R146	RESISTOR, fixed: comp; 56,000 ohms ±10%; 1 w; JAN type RC30BF563K.	R116: Screen bleeder for V101 R117: Screen dropping for V101. R118: Plate load for V101. R146: Part of power supply bleeder.	3RC30BF563K
R106	RESISTOR, fixed: 83,000 ohms ±1%; ½ w	Part of frequency-determining bridge.	3Z6683–1
R103	RESISTOR, fixed: comp; 85,000 ohms ±1%; ½ w.	Part of frequency-determining bridge.	3Z6685–5
R149	RESISTOR, fixed: comp; 100,000 ohms ±10%; 1 w; JAN type RC30BF104K.	Grid resistor for V108	3RC30BF104K
R128	RESISTOR, fixed: comp; 120,000 ohms ±10%; 1 w; JAN type RC30BF124K.	Screen bleeder for V103	3RC30BF124K

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
R151	RESISTOR, fixed: comp; 150,000 ohms ±10%; 1 w; JAN type RC30BF154K.	Grid voltage dropping resistor for V108.	3RC30BF154K
R131, R145, R120	RESISTOR, fixed: comp; 560,000 ohms ±10%; 1 w; JAN type RC30BF564J.	R131: Grid resistor for V104 R145: Plate load for V107. R120: Grid resistor for V102.	3RC30BF564J
R107	RESISTOR, fixed: comp; 830,000 ohms ±1%; 1 w.	Part of frequency-determining bridge.	3Z6783
R102	RESISTOR, fixed: comp; 850,000 ohms ±1%; ½ w.	Part of frequency-determining bridge.	3Z6785–2
R108	RESISTOR, fixed: comp; 8.3 meg ±1%; 1 w	Part of frequency-determining bridge.	3Z6808C3
R101	RESISTOR, fixed: comp; 8.5 meg ±1%; 1 w	Part of frequency-determining bridge.	3Z6808E5
R109, R137	RESISTOR, variable: comp; 500 ohms ±20%; 2 w.	R109: Bridge frequency adjustment potentiometer (X1000 RANGE). R137: Output meter calibration potentiometer.	3Z7250–80
R114	RESISTOR, variable: comp; 1000 ohms ±20%; 2 w.	Controls negative feedback to V101.	3Z7310–112
R110	RESISTOR, variable: comp; 5000 ohms ±20%; 2 w.	Bridge frequency adjustment potentiometer (X100 RANGE).	3Z7350–127
R138	RESISTOR, variable: comp; 5000 ohms ±20%; 2 w.	Output voltage level control	3Z7350–126
R111, R147	RESISTOR, variable: comp; 50,000 ohms ±20%; 2 w.	R111: Bridge frequency adjustment potentiometers (X10 RANGE). R147: Power supply bleeder resistor.	3Z7450–149
R112	RESISTOR, variable: comp; 500,000 ohms ±20%; 2 w.	Bridge frequency adjustment potentiometer (X1 RANGE).	3Z7498–50.153
X102 through X109	SOCKET, tube: octal; 1 piece saddle mtg; JAN type TSB8T101.	Sockets for V102 through V109	2Z8678.326
X101	SOCKET, tube: 8 cont, medium, octal; 1 piece saddle mtg; JAN type TSB8T102.	Socket for V101	2Z8678.327
S1	SWITCH, rotary: 2 pole, 4 position; 2" dia x 2⅝" d o/a.	RANGE switch	3Z9825–62.649
S5	SWITCH, rotary: 3 sect; #1 sect, 1 pole, 6 positions; #2 sect, 1 pole, 6 positions; #3 sect, double pole, 6 positions; 2" dia x 3" lg o/a.	ATTENUATOR switch	3Z9825–62.554
S4	SWITCH, thermostatic: SPST; 2" lg x 1¾" wd x ¾" h o/a.	THERMOSTAT control	3Z9695–1.3
S2, S3, S6	SWITCH, toggle: SPST; JAN type ST12A	S2: OSC. ON-OFF switch S3: HEATER ON-OFF switch. S6: FREQ. METER ON-OFF switch.	3Z9863–12A
T101	TRANSFORMER, power: fil and plate type; input 1500 v, 50 to 1600 cyc, 1 phase; 4 output wnd; secd #1, 820 v CT, .1 amp; secd #2, 6.3 v at 1.25 amp; secd #3, 6.3 v at 2.5 amp; secd #4, 5 v at 2 amp; HS metal case; 5¼" lg x 4" wd x 4⅜" d o/a.	Power transformer	2Z9619–262
V101, V103	TUBE, electron: JAN type 6SJ7	Oscillators, amplifier	2J6SJ7
V102	TUBE, electron: JAN type 6AG7	Amplifier inverter	2J6AG7
V104	TUBE, electron: JAN type 6V6	Power amplifier	2J6V6
V105	TUBE, electron: JAN type 5Y3GT	Rectifier	2J5Y3GT

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
V106	TUBE, electron: JAN type 6Y6G	Voltage regulator	2J6Y6G
V107	TUBE, electron: JAN type 6SQ7	D-c amplifier	2J6SQ7
V108	TUBE, electron: JAN type 6J5	Cathode follower	2J6J5
V109	TUBE, electron: JAN type 0A3	D-c amplifier bias	2J0A3

RESISTOR COLOR CODES



COLOR	SIGNIFICANT FIGURE	MULTIPLYING VALUE	TOLERANCE (%)
BLACK	0	1	± –
BROWN	1	10	± 1
RED	2	100	± 2
ORANGE	3	1,000	± 3
YELLOW	4	10,000	± 4
GREEN	5	100,000	± 5
BLUE	6	1,000,000	± 6
VIOLET	7	10,000,000	± 7
GRAY	8	100,000,000	± 8
WHITE	9	1,000,000,000	± 9
GOLD	–	0 1	± 5
SILVER	–	0 01	± 10
NO COLOR	–	–	± 20

NOTES

* INSULATED FIXED COMPOSITION RESISTORS WITH AXIAL LEADS ARE DESIGNATED BY A NATURAL TAN BACKGROUND COLOR NON-INSULATED FIXED COMPOSITION RESISTORS WITH AXIAL LEADS ARE DESIGNATED BY A BLACK BACKGROUND.

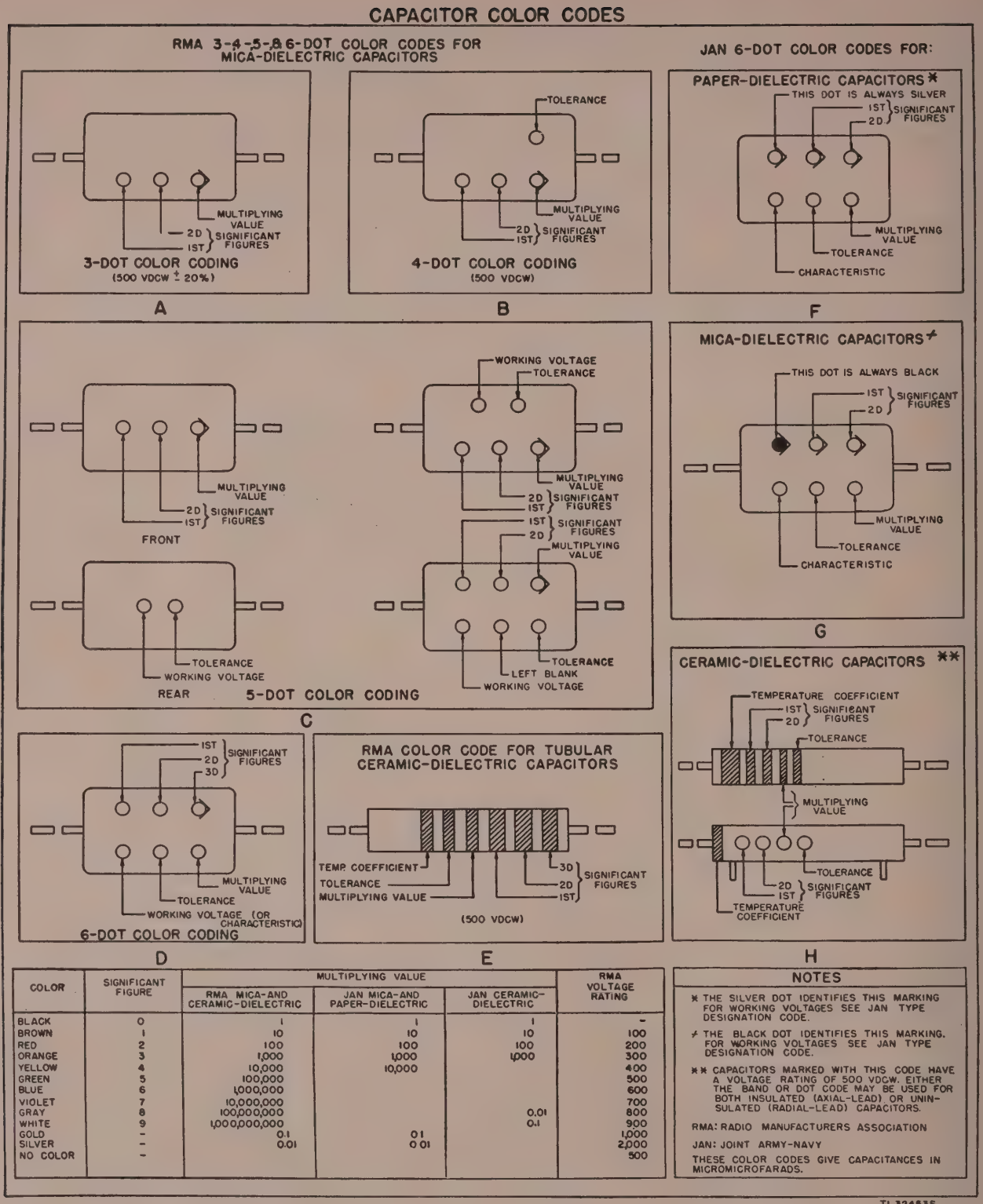
* RESISTORS WITH AXIAL LEADS ARE INSULATED. RESISTORS WITH RADIAL LEADS ARE NON-INSULATED.

RMA: RADIO MANUFACTURERS ASSOCIATION

JAN: JOINT ARMY-NAVY

THESE COLOR CODES GIVE ALL RESISTANCE VALUES IN OHMS

Figure 22. Resistor color codes.



COLOR	SIGNIFICANT FIGURE	MULTIPLYING VALUE			RMA VOLTAGE RATING
		RMA MICA-AND CERAMIC-DIELECTRIC	JAN MICA-AND PAPER-DIELECTRIC	JAN CERAMIC-DIELECTRIC	
BLACK	0	1	1	1	-
BROWN	1	10	10	10	100
RED	2	100	100	100	200
ORANGE	3	1,000	1,000	1,000	300
YELLOW	4	10,000	10,000		400
GREEN	5	100,000			500
BLUE	6	1,000,000			600
VIOLET	7	10,000,000			700
GRAY	8	100,000,000		0.01	800
WHITE	9	1,000,000,000		0.1	900
GOLD	-	0.1	0.1		1,000
SILVER	-	0.01	0.01		2,000
NO COLOR	-				500

NOTES

* THE SILVER DOT IDENTIFIES THIS MARKING FOR WORKING VOLTAGES SEE JAN TYPE DESIGNATION CODE.

≠ THE BLACK DOT IDENTIFIES THIS MARKING. FOR WORKING VOLTAGES SEE JAN TYPE DESIGNATION CODE.

** CAPACITORS MARKED WITH THIS CODE HAVE A VOLTAGE RATING OF 500 VDCW. EITHER THE BAND OR DOT CODE MAY BE USED FOR BOTH INSULATED (AXIAL-LEAD) OR UNINSULATED (RADIAL-LEAD) CAPACITORS.

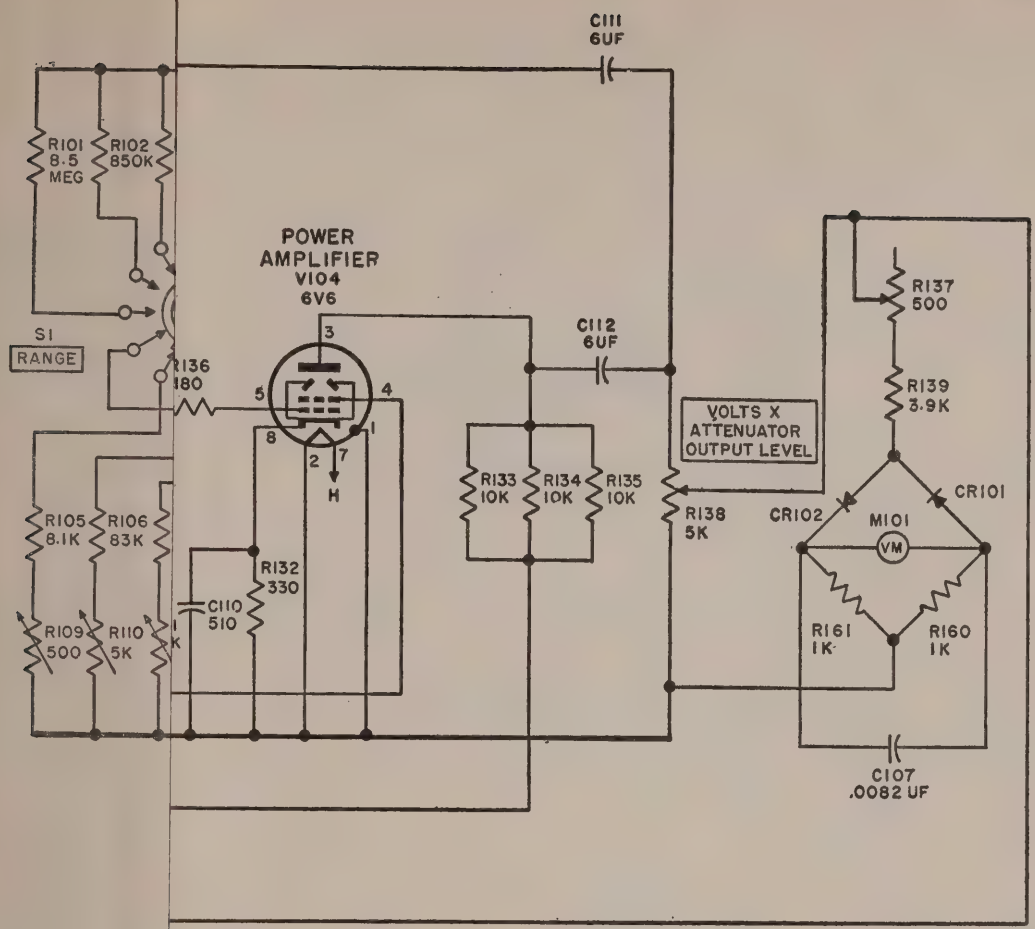
RMA: RADIO MANUFACTURERS ASSOCIATION

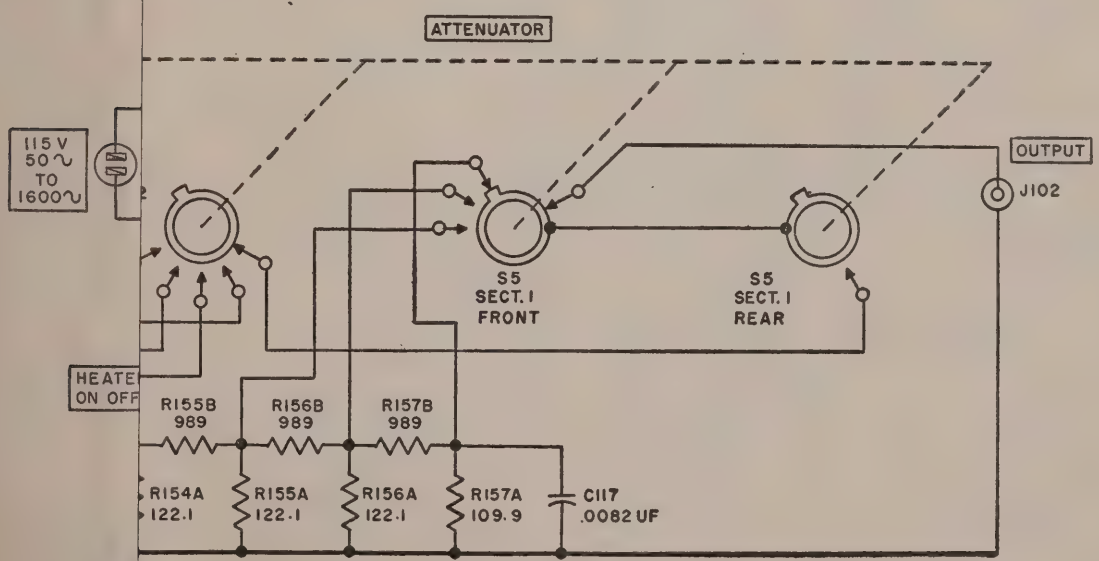
JAN: JOINT ARMY-NAVY

THESE COLOR CODES GIVE CAPACITANCES IN MICROMICROFARADS.

TL 32453S

Figure 23. Capacitor color codes.





1. UN
IN
2. RC
E
SE
CU
3. SI
4. S

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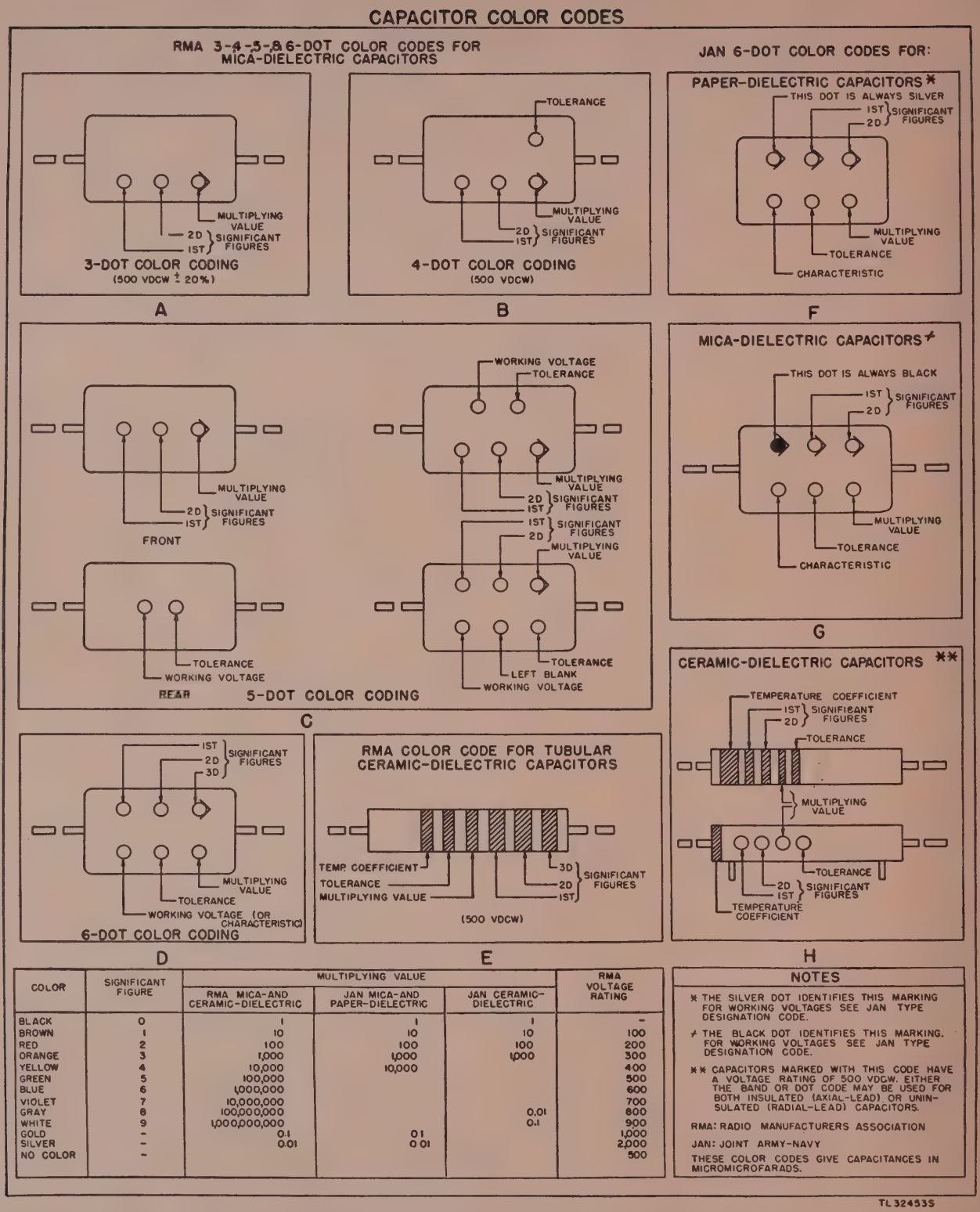


COLOR	SIGNIFICANT FIGURE	MULTIPLYING VALUE			RMA VOLTAGE RATING
		RMA MICA-AND CERAMIC-DIELECTRIC	JAN MICA-AND PAPER-DIELECTRIC	JAN CERAMIC-DIELECTRIC	
BLACK	0	1	1	1	-
BROWN	1	10	10	10	100
RED	2	100	100	100	200
ORANGE	3	1,000	1,000	1,000	300
YELLOW	4	10,000	10,000		400
GREEN	5	100,000			500
BLUE	6	1,000,000			600
VIOLET	7	10,000,000			700
GRAY	8	100,000,000		0.01	800
WHITE	9	1,000,000,000		0.1	900
GOLD	-	0.1	0.1		1,000
SILVER	-	0.01	0.01		2,000
NO COLOR	-				500

NOTES

* THE SILVER DOT IDENTIFIES THIS MARKING FOR WORKING VOLTAGES SEE JAN TYPE DESIGNATION CODE.

≠ THE BLACK DOT IDENTIFIES THIS MARKING. FOR WORKING VOLTAGES SEE JAN TYPE DESIGNATION CODE.

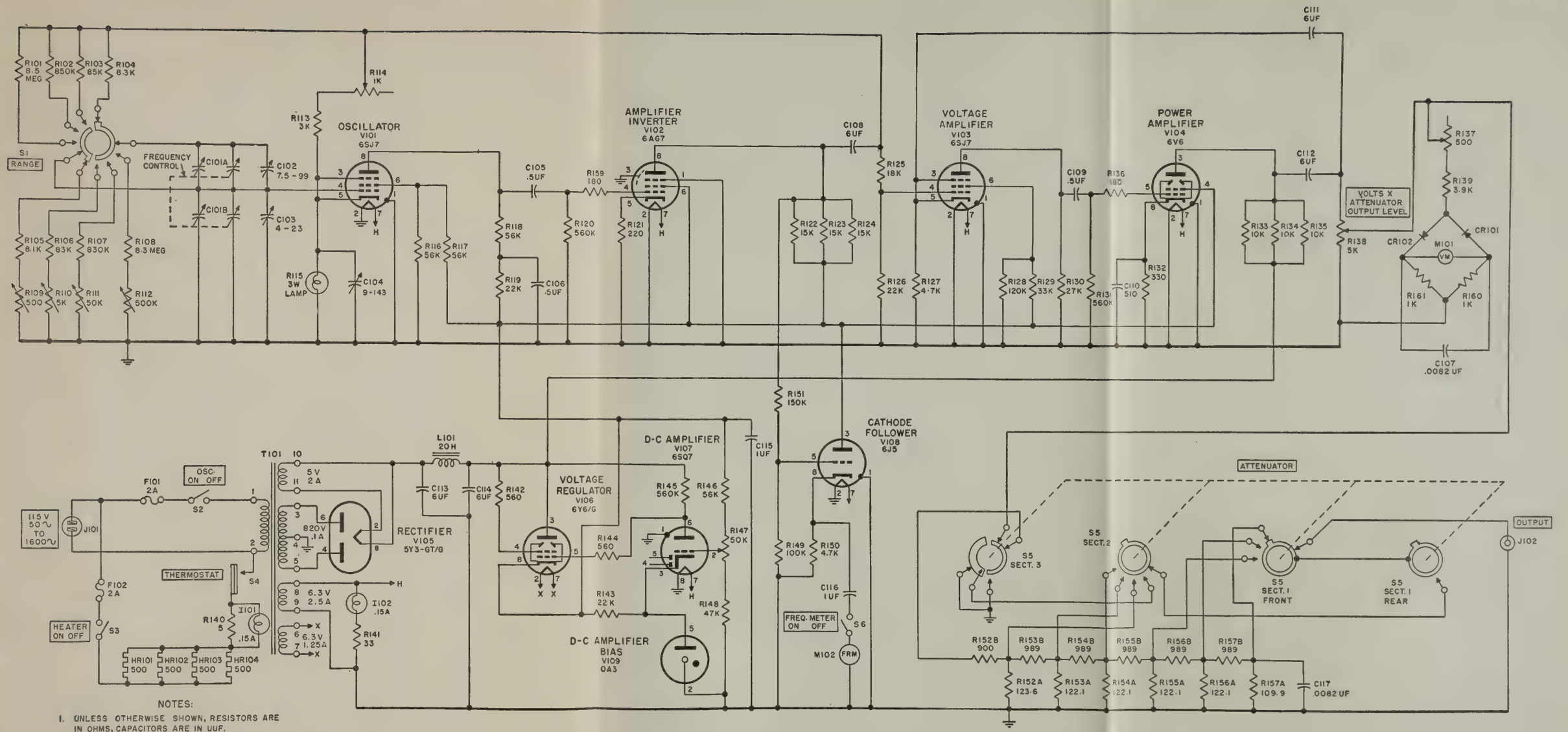
** CAPACITORS MARKED WITH THIS CODE HAVE A VOLTAGE RATING OF 500 VDCW. EITHER THE BAND OR DOT CODE MAY BE USED FOR BOTH INSULATED (AXIAL-LEAD) OR UNINSULATED (RADIAL-LEAD) CAPACITORS.

RMA: RADIO MANUFACTURERS ASSOCIATION

JAN: JOINT ARMY-NAVY

THESE COLOR CODES GIVE CAPACITANCES IN MICROMICROFARADS.

Figure 23. Capacitor color codes.



NOTES:

1. UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.
2. ROTARY SWITCHES ARE VIEWED FROM END OPPOSITE CONTROL KNOB. SECTIONS DESIGNATED 1 ARE CLOSER TO KNOB END.
3. S1 SHOWN IN X1000 POSITION.
4. S5 SHOWN IN .00001 POSITION.

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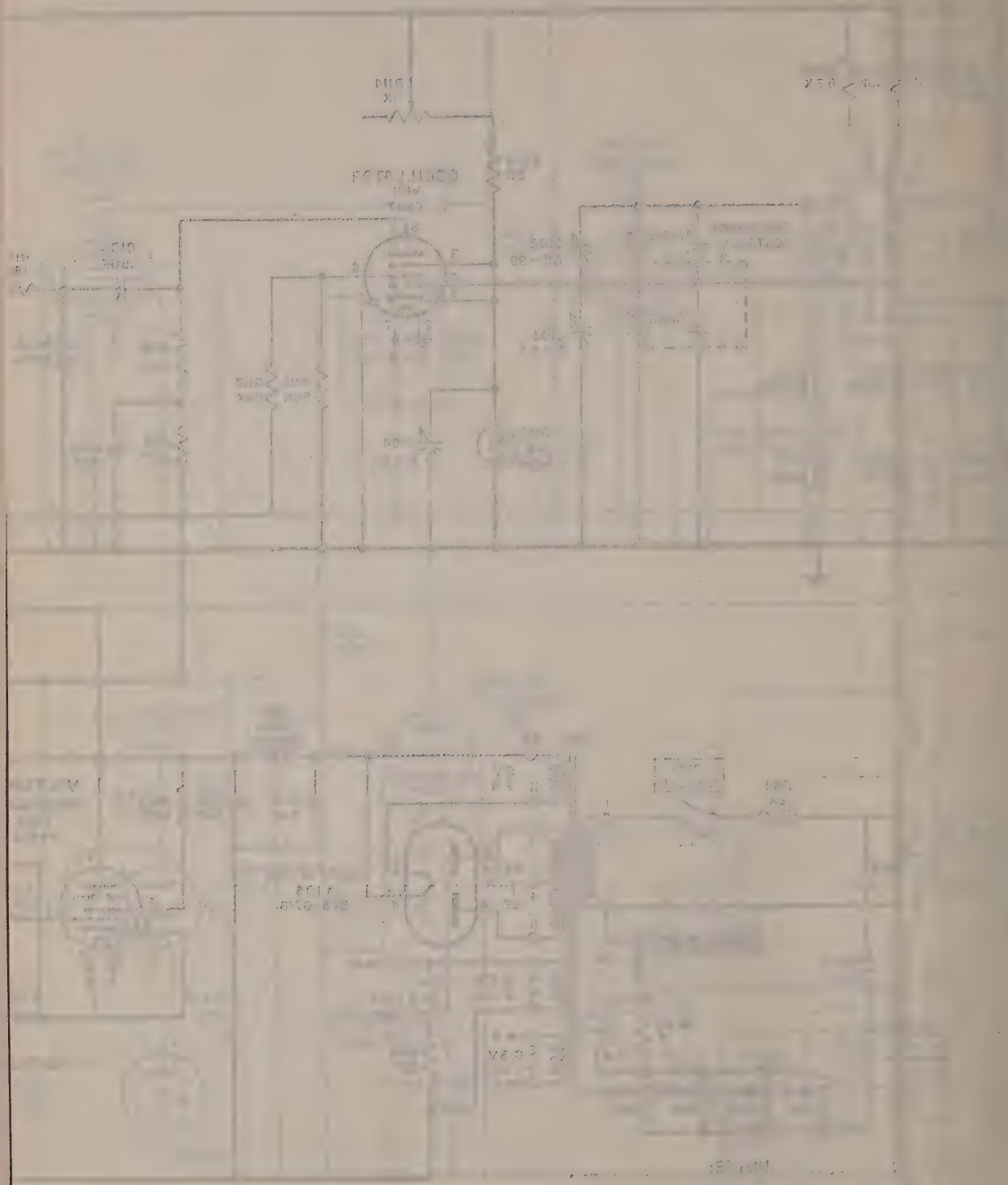
Figure 24. Audio Oscillator TS-382A/U, complete schematic.



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U. S. GOVERNMENT PRINTING OFFICE: 1952—951136